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Queensland Government
Environmental Protection Agency

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A conspectus of *Acacia* subg. *Acacia* in Australia

Les Pedley

Summary

Pedley, L. (2002). A conspecutus of *Acacia* subg. *Acacia* in Australia. *Austrobaileya* 6 (2): 177–186. *Acacia* subg. *Acacia* is represented in Australia by 11 species. A key to species, notes on the geographical ranges and habitats of each and references to published descriptions are given. *A. clarksoniana* and *A. douglasica* are described as new. The lectotypification of *A. pallida* F. Muell. and the application of the name *A. pallidifolia* Tindale are discussed at some length and, as an adjunct, *A. valida* Tindale & Kodela is treated as a synonym of *A. pallidifolia* and *A. turbata* is described for *A. pallidifolia* auct. non Tindale (*A pallida* var. *major* Benth.).

Key words: *Acacia* subg. *Acacia, Acacia pallidifolia, Acacia clarksoniana, Acacia douglasica, Acacia turbata.*

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Introduction

Acacia subg. *Acacia* is represented in Australia by eleven species, two of them naturalised. Except for *A. bidwillii* which extends into subtropical Queensland, the endemic species are confined to the seasonally dry tropics. The species have been adequately collected only in the last 50 years and considerable confusion still exists in their taxonomy and nomenclature. The Australian species are part of the autochthonous Australian flora. The adjacent Malesian region has only two endemic species of *Acacia* subg. *Acacia*, both of which extend to the Asian mainland and neither of which occurs in Australia (Neilsen 1992).

Much evidence has accumulated (Pedley 1986, Brain 1990, Chappill & Maslin 1995) indicating that *Acacia* subg. *Acacia* is generically distinct from the other recognised subgenera: *Acacia* subg. *Phyllodineae* (DC.) Seringe (genus *Racosperma* Martius) and *Acacia* subg. *Aculeiferum* Vassal (genus *Senegalia* Raf.).

Species of the subgenus are, on the whole, distinctive but, as in many other groups of *Acacia*, identification from herbarium specimens may present difficulties. These difficulties are usually caused by inadequate material or specimens taken from depauperate, young or particularly vigorous plants. The key to species makes use mainly of attributes of the indumentum of branchlets and of dimensions and number of parts of leaves, with occasional use of floral characters. Pods of *A. farnesiana* and *A. nilotica* are particularly distinctive but, except for these two, attributes of pods and seeds are not used in the key.

The serious pest status of *A. nilotica* subsp. *indica* in northern Australia and its being the target of biological control measures (Mackey 1998) have prompted this review. Basic information on related taxa is essential for the successful implementation of control programs.

Key to species of *Acacia*

1. Flowers in spikes; axis of leaves 12–14 cm long; (10–)15–17 pairs of pinnae per leaf; leaflets 3–5 mm long, c. 0.7–1.2 mm wide **1. A. sutherlandii**
 Flowers in heads; axis of leaves up to 25(–30) cm long; (1–)2–55 pairs of pinnae per leaf; leaflets 1.5–15 mm long, 0.5–2 mm wide 2

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2. Leaves often borne on short shoots; petiole to 1 cm long; 1 or 2 pairs of pinnae per leaf, their axes 1–2.5 cm long; leaflets 1.5–5 mm long, 0.5–1.2 mm wide; heads of fewer than 10 flowers; seeds woolly, glabrescent **2. A. suberosa**
Leaves not on short shoots; petiole often more than 1 cm long; pinnae usually more than 2 pairs per leaf; heads of more than 15 flowers; seeds glabrous 3

3. Pinnae 22–55 per leaf; leaflets 0.8–1.5 mm long, 0.4–0.7 mm wide **3. A. ditricha**
Pinnae often fewer, but if 22–55 per leaf then leaflets 1.5–5 mm long, 0.7–1.2 mm wide 4

4. Pinnae (1–)2–4 pairs per leaf; leaflets 4–7.5(–9) mm long, 1–2 mm wide; branchlets reddish with conspicuous lenticels; involucel at top of peduncle, hidden by open flowers; pod round in cross-section, 1 cm or more diam. **4. A. farnesiana**
Pinnae rarely fewer than 4 pairs; branchlets pubescent or, if glabrous, then not with conspicuous lenticels, or leaflets wider; pods flat 5

5. Axes of pinnae 4–15(–20) cm long; leaflets large, 4–20 mm long, 1.5–6 mm wide 6
Axes of pinnae 1.5–4 cm long; leaflets smaller, (1–)1.5–6 mm long, 0.5–1.5 mm wide 7

6. Leaflets 1–12 pairs per pinna, each 4–20 mm long, 1.5–6 mm wide; gland minute, inconspicuous, between lowest pair of pinnae; corolla 3–4.5 mm long; branches pendulous **5. A. pachyphloia**
Leaflets 13–34 pairs per pinna, each 5–14 mm long, 1.5–4 mm wide; usually a prominent scutellate gland between or immediately below lowest pair of pinnae of some leaves; corolla to 3.5 mm long; branches not pendulous **6. A. turbata**

7. Ultimate branchlets reddish, glabrous or with long spreading hairs; thin, discoid or elongated gland between or immediately below lowest pair of pinnae 8
Ultimate branchlets not particularly reddish, pubescent with short erect hairs sometimes overtopped by long spreading ones; gland, in some species, large and conspicuous 9

8. Leaflets 16–20(–25) pairs per pinna; flowers large, corolla 3.4–3.8 mm long **7. A. bidwillii**
Leaflets 20–35 pairs per pinna; flowers smaller, corolla 3–3.2 mm long ... **8. A. douglasica**

9. Branchlets with indumentum of uniformly short hairs; axis of leaves 3–6 cm long; up to 10 pairs of pinnae per leaf; petiolar gland absent or inconspicuous; pods densely tomentose, flat, strongly constricted between the seeds forming ± orbicular segments **9. A. nilotica** subsp. **indica**
Branchlets with indumentum of long and short hairs; axis of leaves (3.5–)6–25(–30) cm long; (6–)10–45 pairs of pinnae per leaf; pods ± flat, parallel-sided 10

10. Axis of leaves 6.5–25(–30) cm long; (6–)10–45 pairs of pinnae per leaf; leaflets (1.5–) 1.8–5(–6) mm long, (0.5–)0.7–1.2 mm wide; large conspicuous gland between or immediately below lowest pair of pinnae, (1.3–)1.8–4.5 mm long, 1.4–2.2 mm wide, usually a second gland between most distal pair of pinnae **10. A. pallidifolia**
Axis of leaves 6–8 cm long; 12–16 pairs of pinnae per leaf; leaflets 1.8–2.5 mm long, 0.5–0.7 mm wide; a single gland between or immediately below lowest pair of pinnae, smaller, 1–1.5 mm long, 0.3–0.5 mm wide **11. A. clarksoniana**

1. **Acacia sutherlandii** (F. Muell.) F. Muell.; Icon. Australian Sp. Acacia. dec. 12 (1888); Pedley, Austrobaileya 2: 307 (1980); Kodela & Tindale, Fl. Australia 11A: 196 (2001). *Albizzia sutherlandii* F. Muell., Fragm. 6: 22 (1867). **Type:** Flinders River, *J. Sutherland* 114 (holo: MEL).

A graceful tree with pendulous branchlets which occurs on heavy soils usually in groves in Mitchell-grass (*Astrebla* spp.) grassland from the Barkly Tableland, Northern Territory to the Aramac-Muttaburra area of Queensland. Everist (1986) stated that it is eaten fairly readily by sheep and cattle, though it contains high levels of cyanogenetic glycosides (Conn & Maslin 1982).

2. **Acacia suberosa** A. Cunn. ex Benth., Hook. London J. Bot 1: 499 (1842), Fl. Austral. 2: 420 (1864); Wheeler, F1. Kimberley Reg. 327 t. 97D (1992); Kodela & Tindale, Fl. Australia 11A: 203 (2001).**Type:** Careening Bay,3rd Voyage of *Mermaid*, Sept. 1820, *A.Cunningham* 300 (lecto,*fide* Kodela, Fl. Australia 11A: 642 (2001): K).

Confined to the Kimberley region of Western Australia and the north of the Northern Territory in a variety of habitats (see Wheeler, *loc. cit.*) but often reported from cracking clay soils. The species is probably without any close relatives as it has an unusual combination of attributes, including woolly seeds.

3. **Acacia ditricha** Pedley, Austrobaileya 1: 307 (1980); Wheeler, F1. Kimberley Reg.: 301 t. 98B (1992); Kodela, Fl. Australia 11A: 203 (2001). **Type:** Kowanyama Aboriginal Reserve, Mitchell River, Dec. 1977, *B. Alpher* (holo: BRI).

Tree to 6 m tall with grey-brown corky bark; branchlets densely tomentose with spreading hairs c. 0.5 mm long and shorter (0.2 mm) ones, indumentum extending to base of stipules, petioles and rachises of leaves; pale lenticels evident on older branchlets; stipules spinose, 1–4 mm long on ultimate branchlets, brown. Leaves: axis 5.5–13.5 cm long, including petiole 4–7 mm long, a dark discoid or ellipsoidal gland 0.5–2 mm long, 0.5–1 mm wide, immediately below lowest pair of pinnae, rarely a second smaller gland between the next pair of pinnae; pinnae 22–50 pairs per leaf, rachis 13–20 mm long, each with 24–30 pairs of leaflets each 0.8–1.5 mm long, 0.4–0.7 mm wide, thick, only the midrib visible beneath, a few short spreading hairs near margins. Heads of 20–25 flowers on single axillary peduncles c. 4 cm long with a small involucel about the middle. Flowers 5-merous; calyx c. 1 mm long, shortly lobed, pubescent in the upper part; corolla 2.5–3 mm long; stamens 5–6 mm long, anther with a minute stipitate gland at the apex; ovary pubescent. Pods flat, oblong, 5–10 cm long, 1–1.8 cm wide, valves thinly coriacious, tomentose, occasionally glabrescent, slightly constricted between seeds. Seeds arranged longitudinally, discoid to obloid, 8–12 × 8–10 mm, funicle folded once over seed but not arillate, pleurogram closed or slightly open, areole large, slightly paler than the rest of the seed and depressed.

Much more common and widespread than suggested in the protologue. It has a disjunct distribution: Cape York Peninsula, Queensland, the eastern part of the north of the Northern Territory, and the Kimberley region of Western Australia. It is distinguished from other Australian species by its small leaflets, and large number of pinnae per leaf.

Tindale & Kodela (1996), when describing *A. valida* (=*A. pallidifolia*), compared it with *A. ditricha* but they seemed to have taken a wide view of the latter, including in it *A. douglasica.* In view of this confusion with *A. douglasica*, a description of *A. ditricha*, based on considerably more specimens than were available when the species was first described, is provided.

4. **Acacia farnesiana** (L.) Willd., Sp. Pl., ed. 4. 4:1083 (1806); Benth., Fl. Austral. 2:419 (1864); Ross, Bothalia 11: 471 (1975); Pedley, Austrobaileya 2: 308 (1980); Maslin in Jessop (ed.); Fl. Central Australia: 142 (1981); McVaugh, Fl. Nova Galiciana 5:127 (1987). Clarke *et al.*, Syst. Bot. 14: 559 (1989); Morrison & Davies in Harden, Fl. New South Wales 2: 392 (1981); Tame, Acacias Southeast Australia: 29 t. 1 (photograph

& line drawing) (1992); Nielsen, Fl. Malesiana 11(1): 44 (1992); Symon (ed.2 of Whibley), Acacias Sth Austral.: 292 t. 155 (1992); Wheeler, F1. Kimberley Reg.: 302 t. 98B (1992); Kodela & Tindale, Fl. Australia 11A: 205 (2001). *Vachellia farnesiana* (L.) Wight & Arn., Prod. Fl. Penin. Ind. Orient.: 272 (1834). *Farnesia odora* Gasp., Desc. Nuov. Gen. (1836). *Popanax farnesiana* (L.) Raf., Sylva Tellur. 118 (1838). *Mimosa farnesiana* L., Sp. Pl.: 521 (1753). **Type:** Plate in Aldinus, Descr. Rar. Pl. Rom. Farnesiano 4 (1625) (lecto, *fide* Ross 1975).

Acacia pedunculata Willd. ed. 4. Sp. Pl. 4: 1084 (1806). **Type:** 'Habitat in Java', *T. Horsfield* (holo: B-W, microfiche seen).

Acacia lenticellata F. Muell., J. Proc. Linn. Soc. Bot. 3: 147 (1859). **Type:** Albert River [Qld], 30 Aug. 1856, *F. Mueller* (lecto, *fide* Ross, Fl. Australia 11A: 642 (2001): MEL, *n. v.*)

Native to probably the northern part of the American tropics, introduced into Australia possibly before European settlement, now naturalised in all mainland states except Victoria. It occurs in a variety of habitats but is most common on clay soils, often alluvial in origin. It is regarded as a useful fodder in semi-arid regions but sheds its leaves in dry periods.

Clarke *et al.* examined material of *A. farnesiana* from southern United States, Mexico and the Caribbean and discussed variation within the species. They formally recognised one variant as *A. farnesiana* var. *guanacastensis*, though they also suggested that further study of South American and Caribbean material was desirable. All specimens that I have seen from the Old World are referrable to *A. farnesiana* var. *farnesiana*. Willdenow stated that *A. pedunculata* differed from *A. farnesiana* in having long peduncles, but after examining microfiche of the type, I agree with Clarke *et al.* that the two are conspecific.

5. Acacia pachyphloia W.V.Fitzg. in Maiden, J. & Proc. Roy. Soc. New South Wales 51: 116 (1917); Wheeler, F1. Kimberley Reg.:317 (1992); Dunlop *et al.*, Fl. Darwin Reg. 2: 17 t. 7 (1995); Tindale & Kodela, Austral. Syst. Bot. 9: 311 (1996); Kodela, Fl. Australia 11A: 198 (2001). **Type:** Western Australia: hills near Camp 92 in proximity to the Synot Range, July 1905, *W.V. Fitzgerald* 1267 (lecto, *fide* Tindale & Kodela: NSW, n.v.; iso: PERTH, n.v.).

Tindale & Kodela (1996) distinguished two subspecies, *A. pachyphloia* subsp. *brevipinnula* from the Kimberley region of Western Australia and *A. pachyphloia* subsp. *pachyphloia* from the Kimberley region and the northern part of the Northern Territory. The species usually occurs in eucalypt woodland communities on variety of soils. Differences between it and *A. turbata* its most closely related species are noted under *A. pallidifolia.*

6. Acacia turbata Pedley **sp. nov.** affinis *A. pachyphloia* W.Fitzg. subsp. *pachyphloia* a qua foliis saepe glandula petiolari grandi scutellata ornatis, foliolis plerumque parvioribus, 6–14 mm longis, 1–4 mm latis, discoloris, marginibus recurvatis, 15–25 paribus in quoque pinna, ramulis non cernuis differt. **Typus:** Northern Territory. E of Mary River, ± 13°05'S 131°55'E, 29 Sept. 1946, *S.T.Blake* 17095 (holo: BRI, two sheets).

Acacia pallida auct. non F.Muell. nec Willd; Benth., Fl. Austral. 2:421 (1864).

Acacia pallidifolia auct. non Tindale; Tindale, Telopea 1: 82 (1975); Dunlop *et al.*, Fl. Darwin Reg. 2: 17 (1995); Kodela, Fl. Australia 11A: 199 (2001).

Acacia turbata is most closely related to *A. pachyphloia* but differs in having a large scutellate petiolar gland on some leaves, usually smaller discolorous leaflets with recurved margins, fewer pinnae and more leaflets. The branches are not pendulous. It occurs in the Fitzmaurice River area and sporadically across the extreme north of the Northern Territory usually in eucalypt and mixed woodland on the edges and floors of shallow valleys.

Though Tindale proposed *A. pallidifolia* as a *nomen novum* for *A. pallida* F.Muell, the name should be applied to the species that was described later as *A. valida* Tindale & Kodela. The complex situation is discussed under *A. pallidifolia*. The specific epithet is Latin, meaning 'disturbed' or 'disordered', an allusion to the tangled nomenclature of it and *A. pallidifolia*.

7. Acacia bidwillii Benth., *Linnaea* 26: 629 (1855), Fl. Austral. 2: 420 (1864); Pedley, Austrobaileya 2: 310 (1980); Kodela, Fl. Ausralia 11A: 204 (2001). **Type:** Wide Bay, *Bidwill* (holo: K).

Acacia leptoclada var. (?) *polyphylla* Benth., Fl. Austral. 2: 416 (1864). **Type:** East Coast, *R. Brown* '4331' (holo:K).

Acacia bidwillii var. *polytricha* Domin, Biblioth. Bot. 89: 273 (1926). **Type:** in xeridrymio apud opp. Mungana, Feb. 1910, *K. Domin* '5148' (holo: PR, herb. no. 527948).

The species ranges, in coastal and subcoastal districts of Queensland, from about the latitude of Cooktown to the vicinity of Gayndah, with a marked disjunction to the Mt Isa–Cloncurry region, usually as a scattered understory tree in eucalypt communities. Since it is extremely variable in habit, size of petiolar gland and leaflets, spacing of pinnae along the rachis, and density of indumentum, further study is needed to clarify its taxonomy. Some plants from coastal areas between Townsville and Gladstone approach *A. ditricha* in having leaves with many pinnae and small leaflets, but they lack the indumentum characteristic of that species.

Though treated here as a synonym, the status of *A. bidwillii* var. *polytricha* is still uncertain. Specimens from the Chillagoe-Mungana area (its type locality) and from near Einasleigh, some 200 km to the south, are particularly hairy, but, since most specimens of the species have at least scattered hairs, this may be of little taxonomic significance. The holotype of *A. leptoclada* var. *polyphylla* appears to represent a juvenile plant. It has well developed stipular spines 6 mm long and smaller leaflets than are usual in herbarium specimens of the species. *A. bidwillii* var. *major* Benth. is considered to be the same as *A. pallidifolia*.

8. Acacia douglasica Pedley, **sp. nov.** affinis *A. bidwillii* Benth. et *A. clarksoniana* Pedley; ab illa foliolis pluribus in quoque pinna et floribus parvioribus, et ab hac ramulis tantum pilis dispersis longis obtectis et glandule parviore discoidea inter pinnae paria infima differt. **Typus:** Northern Territory. 0.5 km W of Douglas River, 13°47' 131°23', 23 Oct. 1974, *M. Parker* 508 (holo: BRI; iso: DNA,& (n.v.) CANB, NSW).

Acacia 'Douglas R.', Dunlop *et al.*, Flora of Darwin Region 2: 20 t. 4 (1995).

Acacia ditricha auct. non Pedley; Tindale & Kodela, Austral. Syst. Bot. 9: 311 (1996), *pro parte*.

Tree to 5 m tall; bark corky, grey-brown; branchlets reddish, angular with scattered straight hairs 0.3 mm long, reddish glandular trichomes on growing tips; stipules on flowering stems, sparse, straight, c. 0.75 mm long. Leaves: axis 40–75 mm long (including petiole 5–8 mm), scattered to moderately dense hairs on broadly sulcate surface, disc-like gland between lowest pair of pinnae; pinnae in 11–22 opposite or subopposite pairs, axis 15–30 mm long, a few hairs; pinnae with 20–35 pairs of oblong leaflets, each 1.6–2.2 mm long, 0.5–0.7 mm wide, thick, veins obscure, glabrous or with a few marginal hairs. Heads of 15–30 flowers on peduncles usually single in upper axils; peduncles c. 40 mm long with scattered long hairs; involucel in upper half; receptacle with stiff hyaline hairs; bracteoles narrowly spathulate, c. 1.5 mm long, subglabrous. Flowers 5-merous; calyx c. 1.6 mm long, lobes 0.3 mm long with a few long hairs on tips; corolla c. 3.2 mm long, lobes c. 0.7 mm long with long hairs and minute bladder-like trichomes on margins; stamens c. 7 mm long, some anthers with stipitate globular appendages; ovary pubescent. Pods c. 6.5 cm long and 1.5 cm wide, described as 'creamy-coloured', somewhat pubescent but becoming black and glabrous with age; seeds longitudinal, obloid, c. 10 mm long and c. 9 mm wide; pleurogram prominent, open; areole large, depressed. Fig 1C,D.

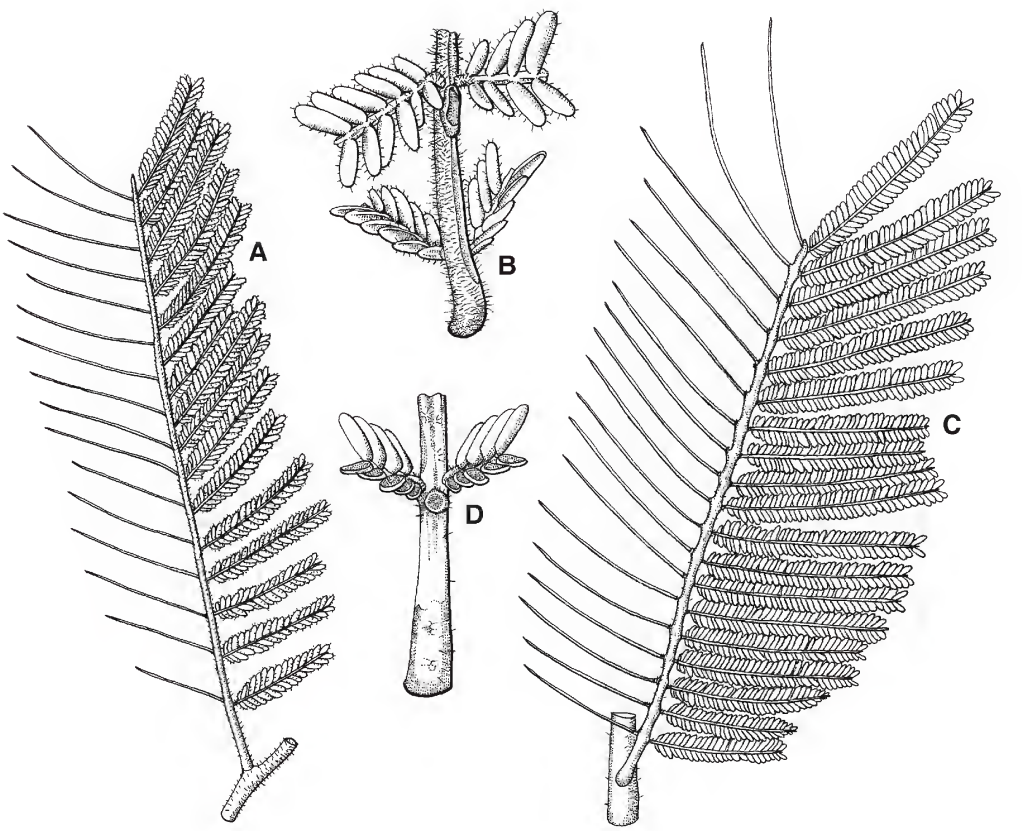


Fig. 1. A & B: ***Acacia clarksoniania***. A. leaf × 1; B. petiole with indumentum and nectary × 3. C & D: ***A. douglasica***. C. leaf × 1; D. petiole with indumentum and nectary × 3. A & B: *Clarkson* 3585 (BRI). C: *Rankin* 1232 (BRI). D: *Tindale* 6098 (BRI).

Distribution and habitat: Known only from the Douglas–Daly Rivers area where it occurs on cracking clay soils (*fide* Dunlop *et al.*).

Affinities: Its closest relative is *A. bidwillii* with *A. clarksoniana* more distant. It has more leaflets per pinna and the leaflets are smaller than those of *A. bidwillii*. It lacks the rather dense indumentum of *A. clarksoniana* and has smaller flowers. Tindale & Kodela compared *A. valida* (= *A. pallidifolia*) to *A. ditricha* but from a specimen seen (*Tindale* 6098, BRI), it seems that they included *A. douglasica* in their circumscription of *A. ditricha.*

Etymology: The specific epithet consists of the name of the river, Douglas, with the Latin adjectival suffix-*ica.*

9. Acacia nilotica (L.) Willd. ex Del., Fl. Aegypt. Ill.:79 (1813); A.F. Hill, Bot. Mus. Leafl. Harvard Univ. 8: 97 (1940); Brenan, Fl. Trop. East Africa: Legum. Mimosoid.: 89 (1959); Ross, Mem. Bot. Surv. Sth Africa 44: 106 (1979). **Type:** Egypt, *Herb. Linn* 1228.28 (lecto, *fide* Ross: LINN, n.v.).

One subspecies occurs in Australia.

Acacia nilotica subsp. **indica** (Benth.) Brenan, Kew Bull: 84 (1957); Ross, Mem. Bot. Surv. Sth Africa 44: 107 t. 85e (pod); Pedley, Austrobaileya 2: 309 (1980); Kostermans, Rev. Handb. Fl. Ceylon 1: 488 (1980); Symon (ed. 2 of Whibley), Acacias Sth Austral.: 29 t.

116 (1992); Kodela, Fl. Australia 11A: 204 (2001). **Syntypes:** "East India", *Roxburgh* (K); Oungein, *sine coll.*, *Herb. Benth.* (K).

Native of southern Asia, introduced into Queensland probably as a shade tree particularly in holding yards around abattoirs, and as a fodder. Trees persist around homesteads and watering-points but in recent years the plant has become a serious weed in grassland on heavy soils in central-western Queensland. It extends to the Barkly Tableland of the Northern Territory and occurs also at 'Cordillo Downs' in the extreme north-east of South Australia.

10. Acacia pallidifolia Tindale, *Telopea* 1: 82 (1975).

A. pallida F. Muell, J. & Proc. Linn. Soc., Bot. 3: 147 (1859), *nom. illeg. non* Humb. & Bonpland ex Willd. (1806). *Acacia bidwillii* var. (?) *major* Benth., Fl. Austral. 2: 421 (1864). **Type:** Victoria River, *Mueller* 76 (holo: K; iso: MEL, *fide* Tindale & Kodela, n.v.).

Acacia sp. H Wheeler, F1. Kimberley Reg.: 336 t. 98E (1992).

Acacia valida Tindale & Kodela, Austral. Syst. Bot. 9: 307 (1996); Kodela & Tindale, Fl. Australia 11A: 201 (2001). **Type:** Northern Territory: Mathison Creek, c. 91.5 km W of Katherine on the Victoria Highway, 2 Aug. 1979, *M.D. Tindale* 10101 *et al.* (holo: NSW, n.v.; iso: BRI, K, others n.v.), ***syn. nov.***

Confined to the north of the Northern Territory and the Kimberley region of Western Australia. Tindale & Kodela (1996) have given a detailed description (as *A. valida*) and notes on distribution and habitat of the species.

The correct application of the name *A. pallidifolia* presents some difficulties. Bentham's role in the publication of descriptions of species of *Acacia* by Mueller (1859b) is important in deciding the application of the name *A. pallida* F.Muell. and, consequently, of *A. pallidifolia.* The paper is a quirky one, difficult to deal with under the International Code of Botanical Nomenclature. As a foreword to it, Bentham wrote (*pro parte*): "In so far as the specimens have admitted it, I have, at Dr Mueller's request, carefully compared his species with those nearly allied to them, and added any remarks which suggested themselves at the end of his descriptions. In the few cases where I clearly identified them with others previously described, I have given the published names adding his manuscript ones for the purpose of reference, and retaining his characters as completing our previous knowledge of the plants." Bentham had an unmatched knowledge of Australian acacias; as well as earlier collections of Mueller, he had access to those of Banks and Solander, Brown, and Cunningham. It is not surprising therefore that he was more critical than was Allan Black who edited Mueller's companion paper on eucalypts (Mueller 1859a). Black altered the names of only two of the 38 species of eucalypt treated, both on sound nomenclatural grounds, whereas names of 12 of the 115 species of *Acacia* were changed. Bentham considered 11 of the species described as new by Mueller to be the same as already described species, and two identified as *A. delibrata* var. ? and *A. julifera* to be undescribed species which he named *A. oligoneura* and *A. torulosa* respectively. Bentham suggested that another nine names might be synonymous with published names, but he allowed Mueller's names to stand. Because they were treated as synonyms by Bentham, Mueller's names have been regarded as invalid. All, except *A. calligera*, *A. reclinata* and *A. pterocarpa* (the last a later homonym) have since been validated.

Mueller cited specimens for the great majority of species. Some of the specimens are assigned numbers, which were treated as Mueller's herbarium numbers by Bentham (either, for example, as *Hb. M.* No. 71 for *A. stipulosa* or, more commonly merely as No. 5, No. 40, etc.). The numbers run from 1 to 100, but some 30 are missing, not assigned to taxa; the biggest gap is from 43 to 79. The same number is sometimes used for up to three different species. All of Mueller's numbers were not cited in the text, as the specimens numbered 71 and 90 are mentioned only in Bentham's discussion under *A. oligoneura* and

no. 75 in his discussion under *A. pallida.* The sequence of the numbers does not appear to be correlated with the geographic distribution or the taxonomic relationship of the species. No specimens were sent for six of the species (*fide* Bentham), one of which (*A. plagiophylla*) had been given a herbarium number, while pods of two species were described by Mueller though fruiting specimens had not been sent.

Bentham clearly did more than communicate Mueller's paper and provide notes on new species, as was stated after the title. Bentham's remarks are, however, placed in parentheses, are clearly separated from Mueller's text, and may best be considered as being published as 'Bentham in Mueller', as was done by Tindale & Kodela when they described *A. valida.* There might be a suspicion that some of Mueller's numbers were omitted from the text, but the published material is all that should be considered in typification.

Bentham's notes are therefore not part of the protologue of *A. pallida* F.Muell. and cannot have any bearing on the application of the name. The only specimen cited in the protologue is *Mueller* 76 which was from the Victoria River and had pods (*fide* Bentham's notes). The specimen is in the Herbarium at Kew. According to Article 9.1 of the current International Code of Botanical Nomenclature this must be the holotype of the name *A. pallida* as it is the only specimen designated (though evidently not the only one used) by the author in drawing up his description. Lectotypification, as set out in Article 9.9, is not possible as there are no syntypes and the specimen designated (no. 76) does not belong to more than one taxon. It is irrelevant that Bentham considered 'a flowering specimen of Dr Mueller's marked 75 from McAdam's Range...answered better to his character [of the leaves] and the stipular spines of the *Gummiferae*', and that there is a flowering specimen marked '76, 75' at MEL which is evidently a duplicate of *Mueller* 76 at K. Tindale's lectotypification was therefore unnecessary and is rejected. The name *A. pallidifolia* must therefore be applied to the species later described as *A. valida* while the taxon represented by the specimen *Mueller* 75 (and presumably of *Mueller* 75,76, Tindale's 'lectotype' of *A. pallida*) is still without a legitimate name at the rank of species. It is treated here as *A. turbata.*

Blake (1953) pointed out that Mueller sometimes retained only fragments of his specimens and sometimes sent everything to Kew. Mueller (1857) wrote 'Let me however, Sir William [Hooker], state that you receive always the whole of the specimens of every rare kind, nothing of many species having been retained at all, or that I satisfied myself with a solitary leaf and flower, or fruit, in many cases.' The specimen *Mueller* 76 can then be reasonably treated as the holotype of *A. pallida* F.Muell. Perhaps Mueller retained what he considered a representative piece of the species which he labelled '76,75', or perhaps a piece was returned from Kew so labelled.

Among the species described by Mueller (1859), *A. pallida* is unusual in that it is one of only two for which Bentham mentioned in his notes a specimen not cited by Mueller. It might be argued that Bentham was co-author of the name *A. pallida.* If this argument were accepted then lectotypification of the name would be necessary. Tindale's treatment would result in *A. pallidifolia* being the correct name for *A. turbata* as recognised here and *A. valida* for the species treated here as *A. pallidifolia.* Such an argument however is untenable. Bentham,in separating his comments from Mueller's text, made it clear that he considered Mueller to be the author of the paper. It would be contrary to the spirit of Bentham's commentary to regard him as co-author.

11. Acacia clarksoniana Pedley, **sp. nov.** affinis *A. pallidifolia* Tindale a qua foliis glande petiolari parviore, rhachide plerumque breviore, glande inter pinnas apicales nulla, pinnis saepe paucioribus, foliolis paucioribus angustioribusque praeditis differt. **Typus:** Queensland. COOK DISTRICT: 3.9 km from 'New Dixie' homestead, 15°05'S 143°20'E, 15 Oct. 1980, *J.R.Clarkson* 3585 (holo: BRI; iso, K & (n.v.) ILL, MEL, MO, NSW, PERTH, PR, QRS).

Tree facultatively deciduous, to 5 m tall with pale brown tessellated bark; branchlets terete, hirsute with erect hyaline hairs c. 0.1 mm long

and scattered longer ones to 0.7 mm long, red-glandular trichomes conspicuous on developing leaves; stipules on flowering branches straight, rather innocuous, 1.5–2 mm long. Leaves: axis 6–8 cm long (including petiole c.1 cm long), hairs similar to those of branchlets, a sessile gland 1–1.5 mm long, 0.3–0.5 mm wide, c. 0.3 mm thick immediately below lowest pair of pinnae; pinnae 12–16 pairs per leaf, somewhat alternate, each 1.5–2 cm long; leaflets oblong, in 15–26 pairs on each pinna, 1.8–2.5 mm long, 0.5–0.7 mm wide, long hairs on margins, midrib prominent on lower surface. Peduncles 1.5–4 cm long with indumentum similar to that of branchlets, involucel at about the middle; heads of c. 30 flowers, receptacle with long hairs and red-glandular trichomes, bracteoles linear c.1mm long. Flowers 5-merous; calyx 1.2–1.6 mm long, lobes 0.2–0.3 mm long with long hyaline hairs on margins; corolla 2.7–3 mm long, lobes 0.3–0.5 mm long with long hyaline hairs; stamens 4–5 mm long, anthers with a globular appendage c. 0.1 mm diam., ovary glabrous. Pods not seen. Fig. 1 A, B.

***Distribution and habitat*:** Restricted to the south-central part of Cape York Peninsula where it occurs in low hilly country in rather open vegetation. Its geographic range abuts that of *A. ditricha* which occurs in country of lower relief.

***Affinities*:** The species affinities are with *A. pallidifolia* which has a large petiolar gland, a second smaller gland between the most distal pair of pinnae, usually longer pinnae with more, usually, larger leaflets.

***Etymology*:** The species is named in honour of Mr John R. Clarkson who has made many valuable plant collections in tropical Queensland.

Acknowledgements

I am grateful to Mr C.R. Dunlop (DNA) for providing collection data for *Acacia farnesiana* in the Northern Territory, and to the Director, and members of the Legume Section, Royal Botanic Gardens, Kew for allowing me to work at the herbarium (K) for an extended period.

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Appendix

Collections examined. *Acacia bidwillii* (bid), *A. clarksoniana* (cla), *A. ditricha* (dit), *A. douglasica* (dou), *A. farnesiana* (far), *A. nilotica* subsp. *indica* (nil) *A. pachyphloia* subsp. *brevipinnula* (pac/bre), *A. pachyphloia* subsp. *pachyphloia* (pac/pac), *A. pallidifolia* (pal), *A. suberosa* (sub), *A.sutherlandii* (sut) and *A. turbata* (tur). The collection number given is that of the principal collector. In some cases (for example, Perry & Lazarides and Everist & Smith) the collectors are considered to be jointly responsible for the collection. Specimens marked with an asterisk (*) are types of the names of the species.

Adams, L.G. 1026,1206 far. Anderson, E.R. 143, 762A & B bid; 843 nil; 882 bid; 2183, 3678 sut. Andrews, S.B. 37 bid. **Basedow**, H. 49 nil. Batianoff, G.N. 232 far; 900403T, LL9104018, LN9104051, 911040, 9207267, 9303114, 9403158, 9403325, 9805211 bid; 980544 far. Bean, A.R. 826 nil; 3374, 5201, 4158, 9347 bid; 10478 far; 11208 bid; 14109 far. Beaumont, T.E. 7153 far. Blake S.T. 6268 far; 12602, 13697 dit; 16443 pac/pac; 17095*, 17166 tur; 17221 pal; 17977 far; 18886 bid. Bolton M.P. 138, 793 far. Boughton, V. 11, 296, 302 far. Boyland, D.E. 164, 8081 far. Brass, L.J. 279 sut; 2530, 33510 bid. Brenan, B.P.M. 15078 bid. Burbidge, N.T. 5520 sut. Bushell, J.J. 1039 sut. Byrnes, N.B. 628 pal; 2228 sub; 3052, 3057 far; 3107 sut; 3659 bid. **Carolin**, R.C. 6326 far. Cassels, M.L. 14890 bid. Chippendale, G. NT3641 far; NT3718 pal; NT3848 sut. Clark, M.J. 509 dit; 1282 tur. Clarkson, J.R. 1052, 2715 bid, 3367, 3419, 3429 dit; 3584, 3585* cla; 3677 far; 5058 bid; 5461, 6021 far; 9515, 9593 dit; 9600 bid. Cole, M.M. 3000 pal; 5102 far; 6000, 9109, 9127 sut. Cole, M.M. & Provan, D. 20 tur; 362 dit. Correll, R.L. 34 far. Court, O.M. 55 far. Coveny, R. 6522, 6572 far; 6913 bid(?); 6884, NSW107796, NSW107913, NSW107916 far. Cowie, I.D. 352 tur; 7821 pal. Craven, L.A. 3160 nil. Curtis, H.S. 327 far. **Dalliston,** C. HC311 far; HC326 sut. De Lestang, A. 401 sut. Dockrill, A.W. 403 far. Dunlop, C.R. 4023 pal. Durrington, L. 134 far. **Ebersohn**, J. E227 far. Evans, M. 3273, 3443 pal. Everist, S.L. 206 bid; 3028, 3842 sut; 4389, 6338, 7305 far. **Fell**, D.G. DF2214 dit. Fensham, R. 2665 nil. Filson, R. 3362 far. Forbes, S. 2566 far. Forster, P.I. PIF1055 bid; PIF2049, PIF2158 far; PIF8502 bid; PIF13060 dit; PIF15859, PIF18305, PIF18531 bid; PIF18769, PIF20638, PIF22197 far. **Gasteen**, W.G. 376 dit. Gibson, N. 944 bid. Gittins, C.H. 584 bid; 1092, NSW101479 far. Godwin **M.** C912, C1044, GJM1544 bid. Grimshaw, P. PG 2217 bid. **Hacker**, J.B. BH586, JT1091 far. Hall, N. 79/35, H84 sut. Halliday, T.A. 360 bid. Henderson, R.J. H1366 bid; H2157 sut. Henry, N.M. 256 sut. Hill, R. & Lothian, T.R.N. 978 far. Hind, P.D. 11 far; 1069, 2473, NSW108066 sut. Hubbard, C.E. 7306 sut. **Innis,** G. 20 sut. Irvine, A.K. 84, 737 bid. **Jackes**, E.M 20 bid. Jacobs, S.W. 1135 bid; 1422, NSW107574 sut; NSW107580 bid; 1732 dit. Jobson, P.C. 1784 bid. Johnson, R.W. 2169 nil. **Kanis**, A. 1906 far. Kenneally, K.F. 5288 pac/pac; 6770, 8553 pac/bre; 8560 pal; 10682 pac/pac. Knuckey, G. 14 far. **Latz**, P.K. 75 pac/pac. Lazarides, M. 3104 sub; 3967 sut; 4874, 5159, 6515 sub; 6709 pal; 6793 pac/pac; 6959 bid; 7744 sub; 8670 pal. Lazarides, M. & Adams, L.G. 99 tur. Leach, G.J. 3265 pac/pac; 3296 pal; 3405 pac/pac. **McDonald**, K.R. 334 bid; CC47 sut. McDonald, M. 327 pac/pac. McDonald, T.J. 542 far; 1648 bid. McGillivray, W. 3820 pac/pac. McKee, H.S. 9360 bid. Maconochie, J.R. 237, 1175 sub; 1214 dit; 1436 tur; 2655 sut; 2660 cla. Maloney, B. 21 far. Martensz P. 95 far. Maslin B.R. 2085 far. Michael, N. 603 bid. Monkhorst, K.A. 1001 dit. Moriarty, V.K. 215 bid. Morrow, J.C. 27 far. **Neldner**, V.J. 623 far; 2000 bid; 3465 far; 3472 bid; 4085 dit. Niall, J. 128 bid. Nicholson, K. 5450 sut. **Ollerenshaw**, P. PO1074 far; PO1292 sut. Olsen, T. 8/92 dit. O'Keefe, B. 7 sut. **Parker,** M. 508* dou. Parsons, D.J. 89 bid. Pedley, L. 1849 dit; 1943 sut; 2110, 4587 bid; 4846 dit; 4009, 4869, 5015 bid; 5032 far; 5311, 5314, 5319 sut; 5368 nil; 5484 bid. Perry, R.A. 954, 994, 1370, 1454 sut; 2056 pal; 2237, 2680 far. Perry R.A. & Lazarides, M. 2056 pal; 2237 far; 2647 dit; 2680 far; 2833 dit. Podberscek, M. 19 bid. Purdie, R.W. 2276 far. **Rankin**, M.O. 1232 dou; 1282 pac/pac; 1358, 1663 pal. Rodd, A.N. 4473 sut; 4474 bid. Ross, J.H. 3779 tur. **Sands**, M. 5124 far. Scarth-Johnson, V. 68 far; 1140A bid. Searle, SDS645, SDS785 bid. Shelley, J.R. 19 far. Simmons, J.G. 1526, 3376 bid. Slee, A. 2400 far; 2948 pac/pac; 3523 nil. Smith, E.J. 12 far. Smith, L.S. 3526 bid; 4294, 4602 far. Smyrell, G. GS82 sut. Speck, N.H. 1647 pal; 2008 far. Stanley, T.D. 633, 80276 far. Stanton, J.P. 296 bid, JPS2659 dit. Staples, I.B. IBS2124, IBS2219 bid. Stokes, S.J. 16 pal. Story, R. 45 far. Swarbrick, J.T. 9857 bid. Swinbourne, R. 701 dit. **Taylor**, P. 81 far. Thomson, B. 253 nil. Thompson, E.J. 432 bid. Tindale, M.D. 6098 dou; 10101 pal; 10124 far. Tothill, J.C. N1344 far. Trainor, C. 40 far. Trapnell, W.G. 69 pal; 74, E83, 159 bid; 163 sut. **Wannan**, B.S. 1035 far. Warrian, C.M. CMW600 far. Waterhouse, B.M. BMW1903 far; BMW5049 bid; BMW5036, BMW5189 far. Waterhouse, J.T. 11013 far. Webb**,** L.J. 3301 far; 5546, 8154 bid; 11077 far; 11078 sut; 11125 far. Weber, J.Z. 9358 far. White, C.T. 1362 bid; 7020 far; 10575 sut; 12616 far. Widt, M. RHF45 far. Williams, K.A. 185 sut. Wilson, P.L. pac/pac. **Young**, P. 421 bid.

Studies in Euphorbiaceae A.L.Juss. *sens. lat.* 3. A revision of *Bertya* Planch. (Ricinocarpeae Müll.Arg., Bertyinae Müll.Arg.)

David A. Halford and Rodney J.F. Henderson

Summary

Halford, D.A. & Henderson, R.J.F. (2002). Studies in Euphorbiaceae A.L.Juss., *sens. lat.* 3. A revision of *Bertya* Planch. (Ricinocarpeae Müll.Arg., Bertyinae Müll.Arg.). *Austrobaileya* 6 (2) 187–245. The genus *Bertya* Planch. is endemic in Australia. Twenty-eight species are recognized and a key is provided for their identification. The following species are newly described: *B. calycina* Halford & R.J.F.Hend., *B. ernestiana* Halford & R.J.F.Hend., *B. grampiana* Halford & R.J.F.Hend., *B. granitica* Halford & R.J.F.Hend., *B. lapicola* Halford & R.J.F.Hend., *B. linearifolia* Halford & R.J.F.Hend., *B. recurvata* Halford & R.J.F.Hend., and *B. riparia* Halford & R.J.F.Hend. The new combination *B. virgata* (Ewart) Halford & R.J.F.Hend., based on *Beyeria virgata* Ewart, is made. Three new subspecies are described: *B. cunninghamii* subsp. *pubiramula* Halford & R.J.F.Hend., *B. lapicola* subsp. *brevifolia* Halford & R.J.F.Hend., and *B. tasmanica* subsp. *vestita* Halford & R.J.F.Hend. New species are illustrated, while all taxa are described and mapped, and notes on their distribution, habitat and phenology are given. Lectotypes are chosen for *B. findlayi* F.Muell., *B. polymorpha* Baill., *B. polymorpha* forma *mitchelliana* Baill., *B. polymorpha* forma *rosmarinifolia* Baill., *B. polystigma* Grüning, *B. pedicellata* F.Muell., *B. pinifolia* Planch., *B. pomaderroides* F.Muell., *B. rosmarinifolia* Planch., *Ricinocarpos mitchellii* Sonder and *Croton rosmarinifolius* A.Cunn. An epitype is chosen for *B. polystigma* Grüning. All known synonyms are listed here including phase names that were used to identify taxa prior to their formal naming in this publication.

Key words: Euphorbiaceae, *Bertya*, Australian flora, taxonomy, nomenclature

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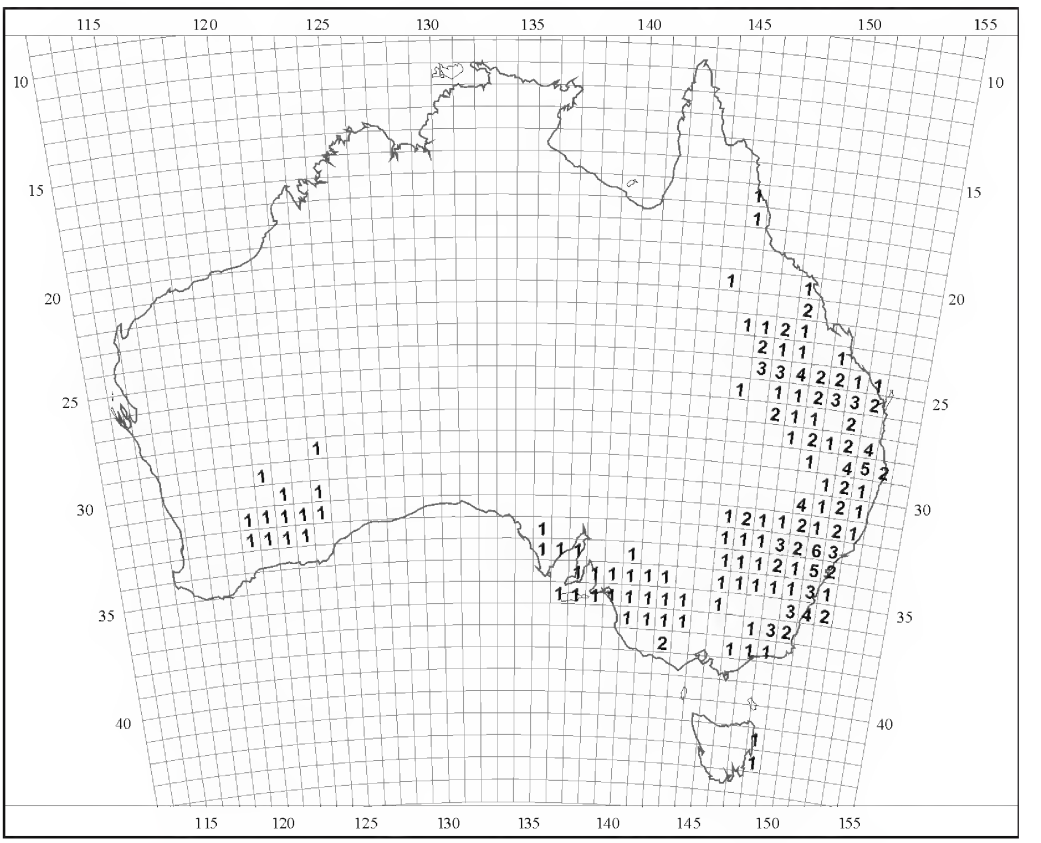
Introduction

The genus *Bertya* Planch. is endemic in Australia. It belongs to the family Euphorbiaceae and has representatives in all states but not the Northern Territory. The majority of species occur in eastern Australia (Map 1). Species are mostly perennial shrubs or rarely small trees in mostly open shrubland, woodland or open forest communities, generally in rocky situations on well-drained sandy soils.

Webster (1994) included *Bertya* in subfamily Crotonoideae Pax, tribe Ricinocarpeae Müll.Arg. and subtribe Bertyinae Müll.Arg., together with three non Australian genera namely *Myricanthe* Airy Shaw and *Cocconerion* Baill. from New Caledonia, and *Borneodendron* Airy Shaw from Borneo. However, *Bertya* seems most closely related to *Ricinocarpos* Desf. and *Beyeria* Miq. from which it can be distinguished by the following combination of features: flowers sessile or shortly pedicellate, solitary, paired or in umbelliform clusters terminal on rudimentary, short or variously elongated branches (peduncles) in distal leaf axils, and subtended by several bracts; male flowers with perianth single-whorled and lacking a corolla; female flowers with perianth mostly single-whorled but rarely with a rudimentary corolla; disc absent in both male and female flowers; pollen grains with small sexinous processes; styles 3-lobed with lobes deeply divided.

In 1845, J.E. Planchon described the genus *Bertya* and included five species (*B. pinifolia, B. rosmarinifolia, B. oleifolia, B. gummifera* and *B. cunninghamii*) within it based on material collected by Alan Cunningham and Charles Fraser from eastern Australia in the early 1800's (Planchon 1845). The generic name commemorates the French botanist and horticulturist Count Léonce de Lambertye (1810-1877).

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Map 1. Distribution of *Bertya* taxa indicating the number of species in each 1° grid square in Australia.

In De Candolle's Prodromus, J. Müller (1866) enumerated ten species of *Bertya* which he arranged into two informal groups based on leaf shape and the degree of curvature of the leaf margin. Those species with leaves of various outlines but not narrowly linear, and with margins revolute but not all the way to midrib, formed one group which included *B. rotundifolia* F.Muell., *B. pomaderroides* F.Muell., *B. oblongifolia* Müll.Arg. and *B. oleifolia* Planch. Those with linear leaves with margins closely revolute to the midrib formed the second group which included *B. gummifera* Planch., *B. mitchellii* (Sond.) Müll.Arg. (name misapplied; see text), *B. rosmarinifolia* Planch., *B. tasmanica* (Sond. & F.Muell.) Müll.Arg., *B. cunninghamii* Planch. and *B. pinifolia* Planch. The species *B. pedicellata* F.Muell. was overlooked by J. Müller but it would have been placed in the first group.

Seven years later, Bentham (1873) accepted nine species as belonging in *Bertya*, placing *B. tasmanica* and *B. oblongifolia* in synonymy of *B. rosmarinifolia* and *B. pomaderroides* respectively. He did not recognize any subdivisions within the genus and made no comment about J. Müller's informal groups.

The most recent account of *Bertya* as a whole is that of Grüning (1913). Grüning recognized nineteen species within this genus, and grouped them into two sections namely *B.* sect. *Euryphylla* and *B.* sect. *Stenophylla* (= *B.* sect. *Bertya*). These groups were based on leaf shape and the degree of curvature of the leaf margin. This division was essentially the same as that given by J. Müller (1866). Each of Grüning's sections was further divided into two subsections (Table 1). His section *B.* sect. *Euryphylla* was split, principally on

whether or not the flowers are pedicellate and the phyllotaxy of the bracts, into *B.* subsect. *Pedunculatae*, containing *B. pomaderroides, B. oblongifolia, B. findlayi* and *B. brownii,* and *B.* subsect. *Sessiliflorae*, containing *B. rotundifolia* and *B. oppositifolia* (= *B. opponens*). *B.* sect. *Stenophylla* (= *B.* sect. *Bertya*) was split on other differences of leaf shape, and the degree of revolution of the margins, into *B.* subsect. *Recurvae*, containing *B. oleifolia, B. polystigma* Grüning, *B. glandulosa* and *B. pedicellata,* and *B.* subsect. *Acerosae* (= *B.* subsect. *Bertya*), containing *B. gummifera, B. pinifolia, B. rosmarinifolia, B. mitchellii* (name misapplied; see text), *B. cunninghamii, B. dimerostigma, B. tasmanica, B andrewsii* (= *Ricinocarpos stylosus*) and *B. quadrisepala* (= *Ricinocarpos muricatus*).

The number of collections and information relevant to the taxa concerned which has become available since Grüning's work have made it necessary for the current study of the genus to be undertaken so that the account of the genus for the Flora of Australia project is an accurate reflection of the current state of knowledge of it. This paper presents the taxonomic conclusions of our revision of *Bertya* in which we recognize 28 species of *Bertya* of which eight are newly described. The names *B. andrewsii* (= *Ricinocarpos stylosus*) and *B. quadrisepala* (= *Ricinocarpos muricatus*) are excluded from *Bertya* and the misapplication of the name *B. mitchellii* is corrected.

Although we have not critically examined Grüning's sectional and subsectional groupings within *Bertya*, it is our opinion that they are somewhat artificial. Species whose floral morphology suggests a recent shared ancestry would be placed in different subsections. For example, while *B. lapicola* (this revision) and *B. linearifolia* (this revision) fit clearly into his '*B.* subsect. *Acerosae*', the closely related species *B. pedicellata* is included in *B.* subsect. *Recurvae*. However, there are obvious groupings within his '*B.* subsect. *Acerosae*', such as *B. gummifera, B. pinifolia, B. recurvata* (this revision) and *B. granitica* (this revision), that more than likely are representatives of a monophyletic unit within *Beryta*. Such inconsistencies have caused us to abandon the recognition of sections and subsections for this revision. More detailed investigations should clarify the phylogenetic relationships between the *Bertya* species we recognize. Further studies into this genus are currently being undertaken by Mr M. Fatimeh as part of his PhD studies at the University of New England in Armidale.

Table 1. Features of sections and subsections of *Beryta* as set out by Grüning (1913).

Bertya sect. ***Bertya*** (***Bertya*** sect. ***Stenophylla*** Grüning)		***Bertya*** sect. ***Euryphylla*** Grüning	
Shrubs. Leaves narrow (linear or obovate-lanceolate), with margin revolute or recurved.		Shrubs or trees. Leaves broad (oblong or elliptic or orbicular), flat or concave.	
Bertya subsect. ***Recurvae*** Grüning	***Bertya*** subsect. ***Bertya*** (***Bertya*** subsect. ***Acerosae*** Grüning)	***Bertya*** subsect. ***Pedunculatae*** Grüning	***Bertya*** subsect. ***Sessiliflorae*** Grüning
Leaves sub-linear or lanceolate, nearly flat, with margin loosely recurved.	Leaves narrow-linear, with margin revolute all the way to midrib.	Flowers pedunculate; leaves shortly petiolate; bracts never opposite.	Male flowers sessile; leaves conspicuously petiolate; bracts 4 or 6, decussate.

Materials and methods

This revision is based on an assessment of morphological characters of about 1200 dried herbarium collections, photographs of types held at BM and CGE and collections and field studies undertaken by the second author from 1988 to 1992 and the first author in 1999 and 2000. Collections from the following herbaria were studied and annotated: AD, BRI, CANB, DNA, HO, K, NSW, MEL, NE and PERTH. The above herbarium acronyms and ones used

in the text to indicate herbaria holding particular specimens follow Holmgren et al. (1990). All specimens citied have been seen unless otherwise indicated (as *n.v.*).

The species treated in the present paper are listed alphabetically. Descriptions of colour of vegetative and floral parts are either from the herbarium labels or from photographs taken by the second author during field studies. Measurements listed are based upon the total variation observed in the herbarium specimens examined. Plant size, flowering and fruiting times and habitat information were obtained from herbarium labels. Common names are given where known. All measurements were made either on fresh or dried material, material preserved in 70% ethanol or dried material reconstituted by placing in boiling water for a few minutes. The morphological data for this revision were recorded using the DELTA system (Dallwitz *et al.* 1993). The distribution maps were produced with MapInfo Version 3 and are based on herbarium specimen locality data.

Taxonomy

Bertya Planchon, *London J. Bot.* 4: 472, t. 16A (1845). **Type:** *Bertya rosmarinifolia* Planch., *fide* G.L. Webster, *Ann. Missouri Bot. Gard.* 81: 110 (1994).

***Derivation of name*:** Named after Count Léonce de Lambertye, French botanist and horticulturist, author of a catalogue of plants of the Marne region of France published in 1847 (Baines 1981).

Monoecious or dioecious shrubs or rarely small trees, often resinous; stems erect or ascending, much branched; branches glabrous or stellate-pubescent, leafy throughout. Leaves exstipulate, sessile or shortly petiolate, alternate rarely opposite, persistent or caducous, glabrous or sparsely hairy and smooth or scabrid adaxially, varyingly pubescent abaxially, with margins entire, recurved or flat and with basi-laminar glands present or rarely absent. Flowers sessile or pedicellate, solitary, paired or in umbelliform clusters, terminal on rudimentary, short or variously elongated branches (peduncles) in distal leaf axils, subtended by several bracts; perianth mostly single-whorled and lacking a corolla or rarely 2-whorled in female flowers with rudimentary corolla; calyx shortly fused proximally, deeply 4 or 5(rarely 6)-lobed, imbricate (quincuncial), somewhat petaloid; disc absent. Male flowers with calyx lobes usually entire; petals absent or if present then rudimentary; stamens numerous, spreading ± perpendicularly from a central column formed by fusion of bases of filaments; anthers of two separate obloid, parallel but contiguous locules terminal on the free apex of each filament, dehiscing by longitudinal slits; vestiges of styles absent. Female flowers with calyx persistent; lobes sometimes enlarging in fruit, entire or somewhat ciliate on margins; petals absent or rudimentary; ovary 3(rarely 2, 4 or 5)-celled with one pendant ovule in each locule; styles 3(rarely 4), shortly fused at base, spreading to ascending throughout or rarely recurved distally, 2 to several-lobed; lobes ± dorsi-ventrally flattened or terete but grooved abaxially. Fruit capsular, usually 1-seeded by abortion, separating septicidally into mostly three 2-valved cocci. Seeds ovoid, ellipsoid or obloid and usually dorsi-ventrally compressed or rarely subglobose, smooth, carunculate; caruncle creamy-white to yellowish-white, waxy-fleshy; endosperm copious; cotyledons ± equal in width to the radicle.

Key to species of *Bertya*

1. Young branchlets glabrous 2
 Young branchlets sparsely to densely stellate-pubescent 9

2. Adaxial surface of leaf lamina glabrous, smooth 3
 Adaxial surface of leaf lamina with stellate hairs or tuberculate 7

3. Leaves appressed to stem, < 4 mm long (W.A.) **28. B. virgata**
 Leaves spreading from stem, > 4 mm long 4

4. Leaf laminas ≥ 2.5 mm wide; margins recurved with most of abaxial surface of leaf lamina visible (Qld) **5. B. ernestiana**
 Leaf laminas < 2.5 mm wide; margins recurved or revolute to midrib so that usually only midrib of abaxial surface is visible 5

5. Leaf laminas lorate or narrowly oblong, ≤ 10 mm long with length/width ratio <10:1 (W.A.) **4. B. dimerostigma**
 Leaf laminas linear, > 10 mm long with length/width ratio >15:1 6

6. Capsule ≥ 8 mm long; leaf laminas 24–55 mm long with apex acute and with a prominent apiculate gland; stamens 55–80 (Qld) **12. B. lapicola**
 Capsule < 8 mm long; leaf laminas 7–27 mm long with apex obtuse to truncate and without a prominent apiculate gland; stamens 15–40 (Qld, N.S.W., Vic.) **3. B. cunninghamii**

7. Calyx lobes of female flowers glabrous (Qld) **22. B. recurvata**
 Calyx lobes of female flowers fimbriate 8

8. Leaf lamina length/width ratio < 25:1, 15–27 × 1.5–2.6 mm (Qld) **9. B. granitica**
 Leaf lamina length/width ratio > 30:1, 25–60 × 0.8–1.5 mm (Qld) **19. B. pinifolia**

9. Leaf lamina margins recurved or revolute to midrib so that usually only midrib of abaxial surface is visible 10
 Leaf lamina margins flat or if recurved then most of the abaxial surface of leaf lamina visible 21

10. Fruiting calyces ≥ two-thirds of capsule length 11
 Fruiting calyces < two-thirds of capsule length 15

11. Female flowers ± sessile; adaxial surface of leaf lamina moderately to densely tuberculate with persistent hair stipes 12
 Female flowers pedicellate; pedicels 1.0–3.5 mm long; adaxial surface of leaf lamina smooth or with scattered tubercules 14

12. Calyx lobes of female flowers glabrous (Qld) **22. B. recurvata**
 Calyx lobes of female flowers fimbriate 13

13. Leaf apices rounded, without apiculate gland (N.S.W.) **10. B. gummifera**
 Leaf apices acute, terminating in an apiculate gland (Qld) **9. B. granitica**

14. Ovary densely stellate-pubescent, not viscid; leaf laminas 19–42 × 1.2–3.1 mm; capsule densely stellate-pubescent (Qld) **2. B. calycina**
 Ovary glabrous or with scattered hairs, viscid; leaf laminas 40–92 × (1.7)3–10 mm; capsule glabrous (Qld) **18. B. pedicellata**

15. Young branchlets viscid, with a sparse indumentum of white stellate hairs 16
 Young branchlets not viscid, with a moderately dense to dense grey-white or golden yellow indumentum of stellate hairs 17

16. Leaf apex rounded to obtuse, not apiculate; leaf laminas < 0.8 mm wide (N.S.W., Qld, Vic.) **3. B. cunninghamii**
 Leaf apex acute, with prominent glandular apiculum; leaves ≥ 0.9 mm wide (N.S.W.) **13. B. linearifolia**

17. Calyx lobes of female flowers glabrous 18
 Calyx lobes of female flowers sparsely to densely stellate-pubescent 19

18. Leaf apex rounded or truncate (N.S.W., Qld) **24. B. rosmarinifolia**
Leaf apex obtuse to acute (N.S.W., S.A., Tas., Vic.) **27. B. tasmanica**

19. Adaxial surface of leaf lamina scabrous, with a moderately dense indumentum of coarse stipitate stellate hairs (N.S.W.) **14. B. mollissima**
Adaxial surface of leaf lamina ± smooth, glabrous or with a sparse to dense indumentum of fine sessile or stipitate stellate hairs 20

20. Adaxial surface of leaf lamina hairy at least when young, glabrescent, not viscid (N.S.W., S.A., Tas., Vic.) **27. B. tasmanica**
Adaxial surface of leaf lamina glabrous, viscid (N.S.W.) **15. B. oblonga**

21. Leaves opposite 22
Leaves spirally alternate 23

22. Young branchlets sparsely to moderately stellate-pubescent, glabrescent; hairs c. 0.1 mm across; calyx lobes of female flowers narrowly ovate to oblong-ovate, 3.2–5.2 × 0.9–1.7 mm; ovary glabrous or with scattered hairs; capsule mostly 1-seeded (Qld) **18. B. pedicellata**
Young branchlets densely stellate-pubescent; hairs 0.2–0.8 mm across, persistent; calyx lobes of female flowers ovate to broadly ovate, 5.0–5.7 × 3.4–5.2 mm; ovary densely hairy; capsule mostly 3-seeded (N.S.W., Qld) **17. B. opponens**

23. Fruiting calyces ≥ two-thirds length of capsule 24
Fruiting calyces < two-thirds length of capsule 26

24. Young branchlets viscid, sparsely to moderately stellate-pubescent, glabrescent; adaxial surface of leaf lamina ± smooth or with scattered tubercules; midrib adaxially viscid, glabrous or not as densely hairy as abaxial surface of leaf lamina 25
Young branchlets not viscid, densely persistent stellate-pubescent; adaxial surface of leaf lamina minutely tuberculate with persistent hair stipes; midrib adaxially not viscid, with indumentum as dense as abaxial surface of leaf lamina (N.S.W., Qld) **16. B. oleifolia**

25. Ovary densely stellate-pubescent, not viscid; leaf laminas linear, 19–42 × 1.2–3.1 mm; capsule densely stellate-pubescent (Qld) **2. B. calycina**
Ovary glabrous or with scattered hairs, viscid; leaf laminas linear-elliptic or linear-obovate, sometimes linear, 40–92 × (1.7)3–10 mm; capsule glabrous (Qld) **18. B. pedicellata**

26. Adaxial surface of leaf lamina glabrous, ± smooth 27
Adaxial surface of leaf lamina sparsely to moderately stellate-pubescent, at least when young, if glabrescent then sparsely to moderately tuberculate with persistent hair stipes 30

27. Peduncles ≥ 7 mm long (N.S.W.) **21. B. pomaderroides**
Peduncles < 7 mm long 28

28. Calyx lobes of female flowers ≤ 2.5 mm long, sparsely to densely stellate-pubescent; leaf laminas 8–23 × 1.3–3.0 mm (N.S.W.) **15. B. oblonga**
Calyx lobes of female flowers > 2.5 mm long, glabrous; leaf laminas 19–46 × 2.5–9.0 mm 29

29. Young branchlets with pale golden-yellow indumentum; petioles 1.5–3.5 mm long; female flowers sessile; calyx lobes of female flowers 4.2–4.6 mm long; capsules 7.5–9.3 mm long (N.S.W., Vic.) **6. B. findlayi**
Young branchlets with whitish coloured indumentum; petioles 0.9–1.5 mm long; female flowers pedicellate with pedicels 0.3–1.1 mm long; calyx lobes of female flowers 2.8–3.2 mm long; capsules 6.7–7.3 mm long (Vic.) **8. B. grampiana**

30. Peduncles ≥ 6 mm long (N.S.W.) **1. B. brownii**
Peduncles < 6 mm long 31

31. Leaf laminas ovate to orbicular, rarely narrowly ovate, with length/width ratio 2:1 rarely 3:1, obtuse to cordate at base 32
Leaf laminas linear to oblong or narrowly obovate or narrowly ovate, with length/width ratio ≥ 4:1, obtuse to attenuate at base 33

32. Leaf laminas ovate to narrowly ovate, 8–22 × 3–10 mm, with apex obtuse to acute; basi-laminal glands stalked, 0.2–0.7 mm long; stamens 45–55 (Qld) **26. B. sharpeana**
Leaf laminas ovate to orbicular, 5–10 × 3–8 mm, with apex obtuse to rounded; basi-laminal glands sessile; stamens 15–30 (S.A.) **25. B. rotundifolia**

33. Abaxial surface of calyx lobes of female flowers sparsely to densely hairy 34
Abaxial surface of calyx lobes of female flowers glabrous 35

34. Calyx lobes of female flowers 2.0–2.7 mm long; leaf laminas 6–24 mm long with adaxial surface densely tuberculate by persistent hair stipes; peduncles 1.0–1.6 mm long (N.S.W.) **14. B. mollissima**
Calyx lobes of female flowers 3.2–4.2 mm long; leaf laminas 21–29 mm long with adaxial surface smooth or sparsely tuberculate by persistent hair stipes; peduncles 1.5–2.5 mm long (N.S.W.) **23. B. riparia**

35. Indumentum on branchlets somewhat coarse, straw-coloured to golden yellow (Qld) **7. B. glandulosa**
Indumentum on branchlets fine, grey-white 36

36. Adaxial surface of leaf lamina with stellate hairs up to 0.1 mm across, glabrescent, remaining finely tuberculate by persistent hair stipes; capsules 7.5–10 × 3.2–3.5 mm; calyx lobes of female flowers 1.5–2.2 mm long; androecium 2.5–4.2 mm long; stamens 30–50 (N.S.W.) **11. B. ingramii**
Adaxial surface of leaf lamina with stellate hairs 0.3–0.6 mm across, glabrescent, ± smooth or with scattered fine tubercules; capsules 5.9–7.1 × 3.5–3.8 mm; calyx lobes of female flowers 1.9–3.1 mm long; androecium 5.0–8.9; stamens 55–75 (Qld) **20. B. polystigma**

1. Bertya brownii S.Moore, J. Bot. 43: 147/148 (1905). **Type**: Australia. [without date,] *R. Brown* [Iter Australiense 3590] (holo: BM *n.v.*, photo BRI, *fide* G.P. Guymer, Austrobaileya 2(5): 429 (1988); iso: CANB [CANB278440]; MEL [MEL537477]; NSW [NSW194843]; ?iso: MEL [MEL114052]).

Bertya astrotricha Blakely, Contr. New South Wales Natl Herb. 1: 120/121 (1941). **Type:** New South Wales. Connelly's Creek, 1.5 miles [c. 2.4 km] NW of Mt Colah, Jun 1918, *W.F. Blakely* (holo: NSW [NSW194834], photo BRI).

Monoecious or apparently dioecious shrubs to 2 m high. Branchlets ± terete with a moderately dense indumentum of stellate hairs, becoming glabrous with age though remaining sparsely tuberculate by persistent hair bases; hairs stipitate, golden-yellow, 0.7–1.1 mm across, with stipes 0.1–0.8 mm long. Leaves petiolate, spirally alternate, spreading; petiole ± plano-convex, 2.2–4.5 mm long, with a moderately dense stellate-pubescent indumentum up to 0.2 mm thick; lamina narrowly elliptic to elliptic, narrowly obovate or oblong-elliptic, (13–)19–54 mm long,(–4) 9–17 mm wide; adaxial surface green, sparsely hairy with stipitate stellate hairs c. 0.5 mm across, smooth; abaxial surface grey-white or pale green, densely hairy with sessile and stipitate stellate hairs up to 0.9 mm across; margin slightly recurved, sometimes finely sinuate; apex obtuse to rounded; base obtuse to cuneate; midvein impressed adaxially, abaxially raised and angular, stellate-pubescent; marginal glands usually present at base of lamina, 1 each side of midrib, 0.1–0.2 mm across, stipitate with stipes 0.1–0.5 mm long. Inflorescences of a single flower, pedunculate, axillary or terminal on a rudimentary, short branchlet in distal leaf axils; peduncles 8–18 mm long; bracts 4–6, persistent to somewhat caducous, narrowly ovate to linear, 1.5–5.5 mm long, 0.4–1.7 mm wide, rounded at tip, stellate-pubescent abaxially, glabrous adaxially. Male flowers sessile or pedicellate with pedicels up to 1 mm long, ± glabrous; calyx lobes 5(sometimes 6), of unknown colour when fresh, elliptic or ovate-elliptic, 3.1–5.6 mm long, 2.0–3.3 mm wide, rounded or obtuse at tip, glabrous except for scattered stellate hairs along margin and along midline abaxially; androecium 5.3–7.4 mm long, 0.4–0.7 mm across; stamens 56–94; filaments c. 0.1 mm long; anthers 0.8–1.2 mm long. Female flowers pedicellate; pedicels 0.5–2.5 mm long in flower, to 4.0 mm long in fruit, sparsely stellate-pubescent; calyx 5(rarely 6)-lobed, light green; tube 0.2–0.5 mm long; lobes ± equal, erect or sometimes slightly recurved distally, narrowly triangular, 2.2–3.0 mm long, 0.5–0.8 mm wide, acute at the tip, glabrous or with a moderately dense indumentum of stipitate stellate hairs abaxially, glabrous adaxially, with margins entire; petals absent; ovary ellipsoid, 1.5–2.0 mm long, 1.1–1.4 mm across, 3-locular, with a moderately dense indumentum of stellate hairs; style with hairy column 0.1–0.3 mm long and 3 spreading limbs; limbs red, 1.9–5.2 mm long, c. 0.6 mm wide, deeply 2– to 5-lobed; lobes 1.5–4 mm long, 0.2–0.3 mm wide. Capsule narrowly ovoid or ovoid-ellipsoid, 9–9.5 mm long, 3.5–4.2 mm across, with a sparse to moderately dense indumentum of stellate hairs, 1-seeded; persistent calyx lobes ≤ half the capsule length. Seed obloid, 5.5–6.5 mm long, 2.7–3.3 mm wide, 2.3–2.8 mm across, dark brown; caruncle pyramidal, c. 2 mm across, c. 1 mm long, creamy-white.

***Selected specimens (from 27 examined)*: New South Wales.** Deua National Park, peak 3 km due W of Bundogeran Hill, Jan 1993, *Albrecht* 5313 (MEL); Broken Bago, State Forest, NE of Comboyne, Sep 1929, *Bailey* (NSW); junction of northern arm of Mullet Creek, near Wondabyne, Oct 1925, *Blakely* (NSW); Big Bend, Cockle Creek, Hornsby, May 1921, *Blakely & Shiress* (NSW); Cedar Creek, Cowan, Sep 1926 *Blakely & Shiress* (NSW); Dee Why, Apr 1922, *Boorman* (NSW); 1 km NE of Condella, Feb 1996, *Carmen* 181 (CANB); Happy Valley, Glen Davis, Mar 1968, *Constable* [NSW131563] (NSW); Katandra Bushland Sanctuary, Mona Vale, Sep 1984, *Coveny & James* 543 (NSW); Darkey Creek, 128.5 km N of Wilberforce on the Windsor - Singleton road, Oct 1990, *Coveny & Makinson* 14385 (BRI, CANB, MEL, NSW); Stewarts Trail, just E of Big Nellie, Lansdowne S.F., 20 km NNE of Taree, Nov 1997, *Gilmour* PG8023 (BRI); Coondella Fire Trail, Deua National Park, Feb 1984, *Gilmour* 4271 (CANB, NSW); near Falls, Big Nellie Road, Comboyne State Forest, about 25 km direct N of Taree, Nov 1997, *Gilmour* 7998 (BRI); Katandra Bushland Sanctuary, Mona Vale, Jan 1969, *Grieve* (NSW); Katandra Bushland Sanctuary, Jul 1991, *Kennedy & Dart* 98 (NSW); Mona Vale road, Warriewood, Mar 1968, *Lee* (NSW); rhyolite knob 1 km N of Coondella Trig., Deua National Park, Jan 1991, *Rodd et al.* 6153 (BRI, MEL, NSW); Warriewood, Jul 1941, *Rupp* (NSW); Deua National Park, Diamond Creek, above 3rd waterfall, Jan 1994, *Taws & Scott* 356 (BRI, CANB, NSW); Ku-ring-gai Chase National Park, Sep 1995, *Weston & McDougall* 1902 (NSW).

***Distribution and habitat*:** *Bertya brownii* is confined to the coastal and subcoastal districts of New South Wales from near Wauchope southwards to Batemans Bay (Map 2). It is recorded from wet and dry sclerophyll forest communities on shallow sandy soils in shady gullies or on steep hill-slopes.

***Phenology*:** Flowers have been recorded for most months of the year, fruits from September to November and February.

***Affinities*:** *Bertya brownii* closely resembles *B. pomaderroides* but differs from that in having generally larger and thinner leaf laminas with a stellate-pubescent rather than glabrous adaxial surface, and a coarser indumentum on the branchlets and abaxial surface of the leaf lamina which also has two size classes of hairs.

***Notes*:** The Constable collection from Glen Davis cited above [NSW131563] has slightly smaller leaves than are typical for this species.

2. Bertya calycina Halford & R.J.F.Hend. **sp. nov.** affinis *B. glandulosae* Grüning maxime ut videtur sed indumento albo non pallide rufo, foliis petiolo 0.6–1.3 mm non 1.6–3.1 mm longo et lamina lineari non lorata, oblonga vel anguste obovata, floribus femineis calycis lobis concavis non plus minusve planis, accrescentibus post anthesin et fructum includentibus differt. *B. pedicellatae* F. Muell. nonnullis formis affinis sed foliis petiolo 0.6–1.3 mm non 1.5–5.2 mm longo et lamina 19–42 × 2–3.1 mm non 40–92 × (1.7–)3–10 mm, et ovario dense pubescenti non glabro vel sparse pubescenti differt. **Typus:** Queensland. WARREGO DISTRICT: c. 30 km NE of Morven, 28 August 1990, *R.J.F. Henderson et al.* H3380 (holo: BRI; iso: CANB, K, L, MEL, NE, NSW, distribuendi).

Bertya sp. (Winneba D.Jermyn 31), Forster & Halford (2002, p. 69).

Monoecious or dioecious, much branched shrubs to 4 m high, viscid on most parts. Branchlets angular, becoming terete with age, with a sparse to moderately dense indumentum of stellate hairs; hairs ± sessile, white, 0.1–0.4 mm across. Leaves petiolate, spirally alternate, spreading; petiole plano-convex, 0.6–1.3 mm long, glabrous, smooth or papillose; lamina linear, 19–42 mm long, 1.2–3.1 mm wide; adaxial surface green, sparsely stellate-pubescent when young, becoming glabrous with age but sparsely tuberculate by persistent hair bases; abaxial surface white, densely hairy with sessile stellate hairs up to 0.2 mm across; margin recurved or sometimes revolute in dried state; apex acute or obtuse to rounded, usually ultimately apiculate with extension from midrib c. 0.1 mm long terminated by a small gland; base obtuse; midvein impressed adaxially, abaxially raised and angular, with scattered stellate hairs on abaxial face and stellate-pubescent laterally; marginal glands present at base of lamina, 1 each side of midrib, 0.1–0.2 mm across, sessile. Inflorescences of a single flower or umbelliform with 2 flowers, sessile or pedunculate, axillary or sometimes terminal on a rudimentary, short branchlet in distal leaf axils; peduncles, where present, 4–8 mm long; bracts 2–8, persistent, narrowly ovate to oblong, 2.1–3.7 mm long, 0.9–1.2 mm wide, acute at tip, stellate-pubescent abaxially, glabrous adaxially. Male flowers sessile; calyx lobes 5, light green with a reddish blush distally, elliptic, 2.7–3.2 mm long, 4.2–5.1 mm wide, rounded at tip, glabrous; androecium 3.5–5.0 mm long, 0.7–0.9 mm across; stamens 56–68; filaments 0.1–0.2 mm long; anthers 0.8–1 mm long. Female flowers pedicellate; pedicels 2.5–3.2 mm long, glabrous or with scattered stellate hairs; calyx 5-lobed, pale yellowish-red; tube 0.9–1.1 mm long; lobes ± equal, erect, oblong-elliptic, 3.8–6.4 mm long in flower, to 9.5 mm long in fruit, 1.5–2.5 mm wide, obtuse at tip, glabrous, with margins entire; petals absent or rudimentary where ovate, up to 0.5 mm long and 0.3 mm wide, stellate-pubescent; ovary globose, 1.4–1.8 mm long, 1.4–1.7 mm across, 3(rarely 2)-locular, densely stellate-pubescent; style with hairy column 0.4–0.5 mm long and 3 spreading limbs; limbs dark red, 3.1–6.2 mm long, 0.4–0.7 mm wide, deeply 3- to 5-lobed; lobes 1.7–3.5 mm long, 0.1–0.2 mm wide. Capsule narrowly ellipsoid, 9.0–10.3 mm long, 5.0–6.1 mm across, densely stellate-pubescent, usually 1-seeded; persistent calyx lobes > half the capsule length. Seed obloid, 6.5–7.5 mm long, 3.8–4 mm wide, 2.6–3.0 mm across, dark brown; caruncle pyramidal, 2.8–3.0 mm across, 2.1–2.6 mm long, creamy-white. Fig. 1.

***Additional specimens examined*:** **Queensland.** WARREGO DISTRICT: ridge crossed by boundary between Winneba section of Chesterton Range and SF 11, Sep 1995, *Grimshaw & Bean* PG2201 (BRI); State Forest 11, Orkadilla, Nov 1989, *Jermyn* 31 (BRI).

***Distribution and habitat*:** *Bertya calycina* is confined to an area of sandstone outcrops at

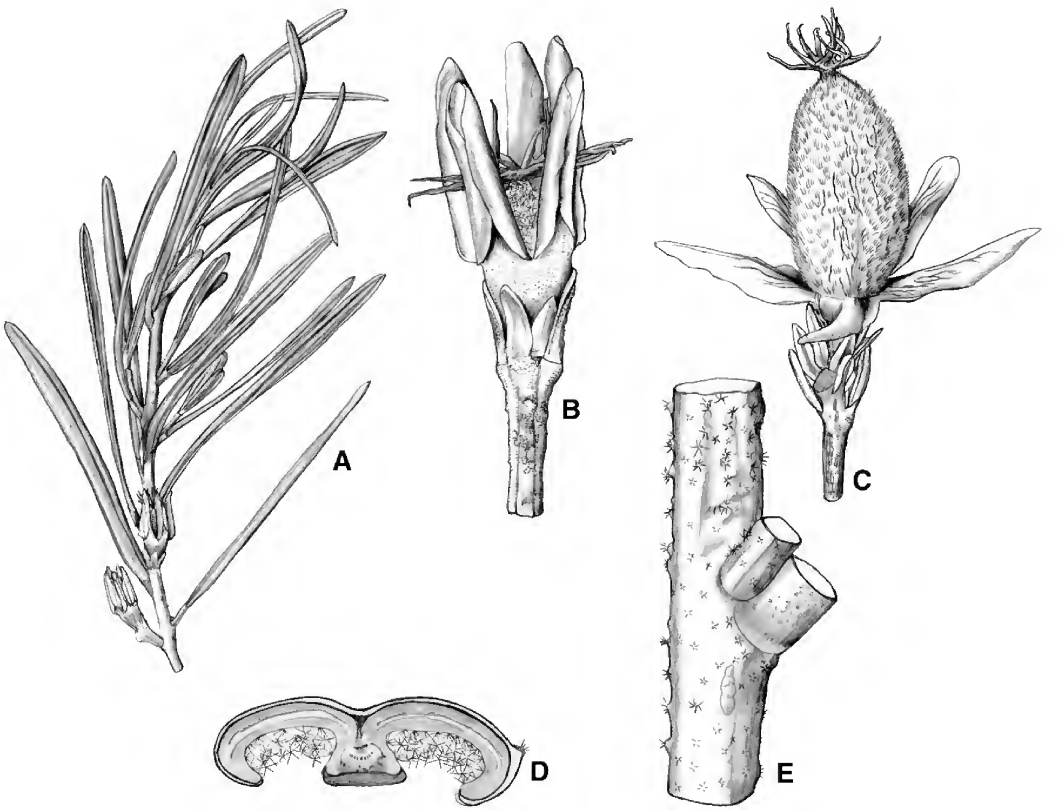


Fig. 1. ***Bertya calycina.*** A. branchlet with fruit. ×1. B. female flower from side. ×4. C. fruit from side. ×3. D. transverse section of leaf. ×16. E. section of branchlet. ×8. A–E from *Henderson* H3380 *et al.* (BRI). Del. W. Smith.

the south-western extremity of the Chesterton Range north-east of Morven, in the south-west of Queensland (Map 3). It grows in mallee woodland communities on shallow sandy to sandy loam soils on the lower slopes and in the gullies around a low sandstone plateau.

***Phenology*:** Flowers have been recorded in August, October and November, fruits in August.

***Affinities*:** *Bertya calycina* seems most closely related to *B. glandulosa* but differs from that by its white rather than pale rusty coloured indumentum, its leaves with shorter petioles (0.6–1.3 mm long compared with 1.6–3.1 mm long) and linear rather than lorate, oblong or narrowly obovate laminas, and in its female flowers with concave rather than more or less flat calyx lobes which enlarge after anthesis and enclose the fruit. *B. calycina* also resembles somewhat some forms of *B. pedicellata* but differs from those by its leaves with shorter petioles (0.6–1.3 mm long compared with 1.5–5.2 mm long) and shorter and narrower laminas (19–42 × 2–3.1 mm compared with 40–92 × (1.7–)3–10 mm), and its densely hairy rather than glabrous or sparsely hairy ovary.

***Notes*:** The only known population of this species consists of about 20 to 30 plants. Though it occurs in a designated State Forest, the area is vulnerable to fire and the plants being resinous increases their susceptibility to elimination. Wild fires in 1992 decreased plant numbers at the site and there was no evidence of regeneration from seed in August of that year.

***Etymology*:** The epithet 'calycina', from Latin

calycinus, with a well-developed calyx, refers to the comparatively enlarged sepals present in both male and female flowers of this species.

3. Bertya cunninghamii Planch., London J. Bot. 4: 273 (1845). **Type:** [New South Wales.] frequent in the western interior quart[er?] of Australia, [without date,] *A. Cunningham* (holo: K (ex herb. Hook.)).

Monoecious, much branched shrubs, 1.5–3m high, viscid on most parts. Branchlets angular, becoming terete with age, glabrous or with a sparse indumentum of stellate hairs, thickly viscid on longitudinal ridges; hairs sessile or stipitate, white, 0.2–0.5 mm across, with stipes up to 0.1 mm long. Leaves petiolate, spirally alternate, spreading; petiole plano-convex,up to 1.0 mm long, glabrous, ± smooth; lamina linear, 8–27 mm long, 0.6–0.9 mm wide; adaxial surface green, glabrous, smooth; abaxial surface white, densely hairy with sessile stellate hairs up to 0.5 mm across; margin recurved to midrib concealing abaxial surface; apex straight or slightly recurved, rounded, obtuse or truncate, usually terminated by small sessile gland; base cuneate; midvein obscure adaxially, abaxially rounded and prominent, ± smooth, glabrous or sparsely stellate-pubescent on abaxial face, stellate-puberulous laterally; marginal glands present at base of lamina, 1 each side of midrib, 0.1–0.2 mm across, sessile. Inflorescences of a single flower or sometimes umbelliform with 2 flowers, pedunculate, axillary; peduncles 1.2–1.8 mm long; bracts 4–7, mostly persistent, narrowly oblong to oblong or narrowly ovate, 0.7–1.7 mm long, 0.3–0.7 mm wide, rounded to truncate at tip, ± glabrous. Male flowers sessile or shortly pedicellate; pedicels up to 0.4 mm long, glabrous; calyx lobes 5, yellow-green with reddish blush, ovate, elliptic or oblong elliptic, 2.6–3.7 mm long, 1.5–2.5 mm wide, rounded at tip, glabrous or with scattered hairs on margin; androecium 2.5–4.2 mm long, 0.3–0.8 mm across; stamens 15–56; filaments c. 0.1 mm long; anthers 0.8–1 mm long. Female flowers sessile or pedicellate; pedicels up to 2.5 mm long, glabrous; calyx 5-lobed, light green; tube 0.2–0.4 mm long; lobes ± equal, erect or sometimes recurved distally, ovate, narrowly oblong or oblong-ovate, 1.3–2.0 mm long, 0.9–1.1 mm wide, acute to obtuse or rounded at tip, glabrous, with margins entire or sometimes minutely fimbriate proximally; petals absent or rudimentary, up to 0.4 mm long and 0.3 mm wide, broadly ovate, glabrous; ovary ovoid or ellipsoid, 1.5–1.6 mm long, 0.8–1.1 mm across, 3(rarely 4)-locular, glabrous; style with glabrous column 0.1–0.3 mm long and 3(rarely 4) spreading limbs; limbs red to maroon, 1.2–1.8 mm long, 0.4–0.6 mm wide, deeply 2– or 3-lobed; lobes 0.7–1.3 mm long, 0.1–0.2 mm wide. Capsule ovoid or ellipsoid, 4.8–7.2 mm long, 3.2–4.2 mm across, glabrous, usually 1-seeded; persistent calyx lobes ≤ half the capsule length. Seed obloid or ellipsoid, 3.9–5.7 mm long, 2.2–2.7 mm wide, 1.9–2.4 mm across, light brown and mottled with dark brown and reddish brown; caruncle pyramidal, 1.1–1.8 mm across, 0.8–1.2 mm long, yellowish-white. gooma bush, wallaby bush, sticky Bertya.

***Notes*:** *Bertya cunninghamii*, as recognized here, is widespread in eastern Australia from Bundaberg, Queensland, through New South Wales to Licola, in eastern Victoria. The species exhibits some discontinuous variation in branchlet vestiture, calyx shape and petiole length as well as differences in habitat of occurrence associated with geographical disjunctions. Three subspecies are therefore formally recognized here.

1. Branchlets sparsely stellate-pubescent **3b. B. cunninghamii** subsp. **pubiramula**
 Branchlets glabrous 2

2. Shrubs to 2 m high; petioles 0.5–1.0 mm long; calyx lobes of female flowers narrowly oblong or oblong-ovate, with margins entire; growing in rocky habitats **3c. B. cunninghamii** subsp. **rupicola**
 Shrubs up to 3 m high; petioles 0.3–0.6 mm long; calyx lobes of female flowers ovate, with margins minutely fimbriate proximally; growing in undulating sandy plains **3a. B. cumminghamii** subsp. **cunninghamii**

3a. Bertya cunninghamii Planch. subsp. **cunninghamii**

Illustration: G.M. Cunningham *et al.* (1982: p. 453).

Shrubs 1.5–3m high; branchlets glabrous. Petioles 0.3–0.6 mm long. Leaf lamina apex rounded. Flowers on peduncles 1.2–1.8 mm long. Male flowers with androecium 3.7–4.2 mm long; stamens 38–56. Female flowers sessile or pedicellate with pedicels up to 2.5 mm long; calyx lobes ovate, acute to obtuse at tip, with margins minutely fimbriate proximally. Seed obloid or ellipsoid, 3.9–5.7 mm long.

***Selected specimens (from 88 examined)*:** **New South Wales.** Charcoal Tank Nature Reserve, S of West Wyalong, Apr 1978, *Blaxell* 1578 (NSW); 3.9 km W of Gubbata on the Naradhan road, Nov 1984, *Coveny & Hind* 12030 (MEL, NSW); Binya State Forest, 1 km N of Griffith to Temora road, Nov 1975, *Crisp* 1654 (AD, CANB); c. 36 km W of Girilambone on dirt road to Canbelego, Oct 1989, *Henderson & Turpin* H3328 (BRI, NSW); c. 6 km W of Weethalle towards Rankine Springs on Mid Western Highway, Sep 1989, *Henderson & Turpin* H3256 (BRI, NSW); c. 7 km E of Naradhan on Naradhan-Gubbata road, Sep 1989, *Henderson & Turpin* H3255 (BRI, CANB, NSW); c. 34 km E of Lake Cargelligo on Condobolin-Lake Cargelligo Road, Sep 1989, *Henderson & Turpin* H3253 (BRI, CANB, NSW); 1 km E of Derriwong on Bogan Gate-Condobolin road, Sep 1989, *Henderson & Turpin* H3251 (BRI, CANB, NSW); c. 3 km S of the Rankine Springs-Goolgowi road, Sep 1989, *Henderson & Turpin* H3262 (BRI, CANB, NSW); c. 57 km NNE of Hillstone towards Matakana on Hillstone to Cobar road, Oct 1989, *Henderson & Turpin* H3324 (BRI, CANB, NSW); Yara Reserve via Condobolin, Oct 1966, *Horne* ANU4220 (CANB); Bundure Station, N of Mt Hope, May 1969, *Martensz* 131 (CANB, NSW); 47 km from Boppy Mountain on road to Girilambone, Apr 1978, *Moore* 7606 (CANB); 6.5 km SW of Tallimba, West Wyalong district, Oct 1972, *Sikkes & Telford* AS502 (CANB); 8 km SE of Mt Hope towards Lake Cargelligo, Oct 1972, *Sikkes & Telford* AS448 (CANB); c. 26 km directly SE of Tullamore, 5 km S of junction with Tullamore-Peak Hill road, Apr 1995, *Taws* 456 (BRI, CANB, NSW); Yara Station, Mt Hope, between Mt Hope and Euabalong, Feb 1964, *Walker* ANU1321 (BRI, CANB, NSW); 25 km SW of Bogan River bridge on "The Range" road, SW of Nyngan, Nov 1984, *Wilson* 6006 (NSW); "Kergunyah", SE of homestead on the boundary fence, Nov 1987, *Wilson & Wilson* 175 (BRI, MEL, NSW).

***Distribution and habitat*:** *Bertya cunninghamii* subsp. *cunninghamii* is confined to central New South Wales from the Cobar and Nyngan areas southwards to the Wyalong district and east to Forbes (Map 4). It commonly grows in woodland or mallee communities dominated by various eucalypts and *Callitris* species on undulating plains on red to red-brown sandy or sandy loam soils.

***Phenology*:** Flowers have been recorded throughout the year, particularly from June to September, fruits from September to May.

3b. Bertya cunninghamii subsp. **pubiramula** Halford & R.J.F.Hend. **subsp. nov.** ab subsp. ceteris *B. cunninghamii* Planch. ramulis pubescentibus non glabris differt. **Typus:** Victoria. by Snowy River, upstream from McKillop's Bridge, 19 September 1979, *N.G. Walsh* 281 (holo: MEL; iso: AD, CANB, NSW).

Shrub to 2 m high; branchlets sparsely stellate-pubescent; hairs sessile or stipitate, white, 0.2–0.5 mm across; stipes up to 0.1 mm long. Petioles 0.1–0.6 mm long. Leaf lamina apex rounded to obtuse. Flowers on peduncles c. 1 mm long. Male flowers with androecium 3.0–4.0 mm long; stamens 18–34. Female flowers pedicellate; pedicels up to 0.8 mm long; calyx lobes narrowly oblong or ovate, rounded to obtuse at tip, with margins fimbriate. Seed not seen.

***Selected specimens (from 25 examined)*:** **New South Wales.** c. 0.5 miles [0.8 km] N of Coolwater Creek, N of Willis and Victoria Border, Aug 1970, *Beauglehole* ACB33881 (AD, CANB, DNA, NSW, MEL); Deua National Park, 2 km ENE of Mongamula Mountain, Jan 1990, *Briggs & Brooker* 2529 (CANB); Coolbaggie Nature Reserve, 12 km ESE of Eumungerie, Aug 1979, *Coveny & Benson* 10427 (NSW); Coolbaggie Nature Reserve, near Eumungerie, Aug 1977, *Morris* (NSW). **Victoria.** Billy Goat Bend, Mitchell River, c. 2.25 miles [3.6 km] NNE of Glenaladale National Park, Apr 1973, *Beauglehole* ACB41764 (MEL, NSW); ridge near Crooked River, 4 miles [c. 6.4 km] N of Dargo Road-Crooked River Road junction, Nov 1957, *Cain* (MEL); near creek at Welcola-Tarralgon High School camp, past Licola (c. 11 km), near Wellington River, Nov 1994, *James* BT191 (MEL); Snowy River, in 1854, *Mueller* (MEL); Razor Back Ridge S of Mt Deddick, May 1962, *Rogers* (MEL); 100-200 m east of Billy Goat Bend Lookout, Mitchell National Park, Mar 1996, *Turner* 1079 (MEL); Cobberas Tingaringy National Park, c. 3 km SE of Sandy Creek on bank of Snowy River, Apr 1989, *Turner* 553 (MEL); Snowy River, 5 km NNW of McKillop's Bridge, Sep 1979, *van Rees* 060 (MEL); Snowy River, Deddick, Sep 1952, *Wakefield* 4698 (MEL); Upper Snowy River, Jan 1948, *Wakefield* 2391 (MEL); Wellington River, c. 11 km (by road) N of Licola, just S of 'Welcola' camp, Dec 1998, *Walsh & Anderson* 4910 (MEL); Snowy River National Park, base of cliff, N face of Mt William, Nov 1996, *Walsh* 4610 (MEL); Upper Snowy River, above McKillop's Bridge, Jan 1948, *Willis* (MEL); Wellington River, 7.5 km N of Licola, Jan 1984, *Yugovic* 20 (MEL).

***Distribution and habitat*:** *Bertya cunninghamii* subsp. *pubiramula* has a disjunct distribution (Map 5). It occurs in New South Wales near Batemans Bay and Dubbo, and in eastern Victoria, from Licola to Cann River. It is recorded mainly from open shrubland communities on shallow sandy soils on rocky outcrops on steep slopes or in riparian habitats. Two collections (*Morris* [NSW195004], NSW and *Coveny & Benson* 10427, NSW) from near Dubbo (Coolbaggie Nature Reserve) are from plants in mallee communities on sandy soils.

***Phenology*:** Flowers have been recorded in August, September and January, fruits from November to February.

***Affinities*:** *Bertya cunninghamii* subsp. *pubiramula* differs from other subspecies of *B. cunninghamii* in having hairy rather than glabrous branchlets.

***Etymology*:** The subspecific epithet is derived from Latin, *pubi-*, softly or weakly hairy, and *ramulus*, branchlet, in reference to the indumentum on the branchlets of this subspecies.

3c. Bertya cunninghamii subsp. **rupicola** Halford & R.J.F.Hend. **subsp. nov.** *B. cunninghamii* Planch. subsp. *cunninghamii* similis ramulis glabris sed statura breviore (ad 1.5 m non 1.5–3 m alta), foliis petiolo leviter longiore (0.5–1.0 mm non 0.3–0.6 mm longo), calycis lobis anguste oblongis ad oblongo-ovatis non ovatis margine integro non minute fimbriato, seminibus parvioribus (3.0–3.5 mm non 3.9–5.7 mm longis) et in locis rupestribus in ripis et montium verticibus non planis arenosis crescens differt. **Typus:** Queensland. MORETON DISTRICT: E of 'Fair Hills', SW of Cooyar, 24 August 1996, *A.R. Bean* 10616 (holo: BRI).

Shrub to 1.5 m high; branchlets glabrous. Petioles 0.5–1 mm long. Leaf lamina apex rounded to truncate or sometimes obtuse. Flowers on peduncles 0.2–1.3 mm long. Male flowers with androecium 2.5–4 mm long; stamens 15–37. Female flowers sessile or shortly pedicellate with pedicels up to 0.8 mm long; calyx lobes narrowly oblong or oblong-ovate, acute to obtuse at tip, with margins entire. Seed ellipsoid, 3.0–3.5 mm long.

***Selected specimens (from 13 examined)*:** **Queensland.** BURNETT DISTRICT: Boondooma Dam, c. 50 km WSW of Murgon, Feb 1999, *Olsen* (BRI). WIDE BAY DISTRICT: Burnett River, adjacent to compartment 32, Cordalba State Forest, WSW of Bundaberg, Aug 1996, *Bean* 10559 (BRI, NSW); Burnett River c. 30 km W of Bundaberg, Aug 1995, *Jansen* (BRI, NSW). DARLING DOWNS DISTRICT: E of 'Fair Hills', SW of Cooyar, Aug 1996, *Bean* 10617 (BRI, NSW). **New South Wales.** Bluff Rock, 37.5 km from Deepwater, Dec 1986, *Beesley & Ollerenshaw* 726 (BRI, CANB, NSW).

***Distribution and habitat*:** *Bertya cunninghamii* subsp. *rupicola* occurs in isolated populations from near Bundaberg, Proston and Cooyar in the south-east of Queensland and from near Glen Innes, in northern New South Wales (Map 6). It is recorded from open shrubland communities on shallow sandy soils in rocky sites on river banks and mountain summits.

***Phenology*:** Flowers have been recorded in May, August and December, fruits in February.

***Affinities*:** *Bertya cunninghamii* subsp. *rupicola* differs from *B. cunninghamii* subsp. *cunninghamii* in having a generally shorter stature (up to 1.5 m high compared with 1.5–3 m high), leaves with slightly longer petioles (0.5–1.0 mm long compared with 0.3–0.6 mm long), narrowly oblong or oblong-ovate rather than ovate calyx lobes, entire rather than minutely fimbriate calyx lobe margins and smaller seeds (3.0–3.5 mm long compared with 3.9–5.7 mm long). This subspecies also grows in different habitats, on rocky sites on river banks and mountain summits in near-coastal areas predominantly east of the Great Dividing Range as opposed to sandplains in inland areas west of the Great Dividing Range.

***Etymology*:** The specific epithet is derived from Latin, *rupes*, rock and *-cola*, dweller or inhabitant, in reference to the rocky habitat of this subspecies.

4. Bertya dimerostigma F.Muell., S. Sci. Rec. 2(5): 98 (1882); *Bertya dimerostigma* F.Muell. var. *dimerostigma*, Grüning in A.Engler, Pflanzenr. H.58: 62 (1913). **Type:** [Western Australia.] Victoria Springs, 30 Sep 1875, [*J.*] *Young* (holo: MEL [MEL114061]; iso: K).

Bertya dimerostigma var. *genuina* Grüning in A.Engler, Pflanzenr. H.58: 62 (1913), *nom. inval.*

Monoecious or sometimes dioecious, much branched shrubs up to 2 m high, mostly viscid. Branchlets ± angular, glabrous, tuberculate or sometimes smooth. Leaves sessile or shortly petiolate, spirally alternate, ascending to spreading; petiole when present ± plano-convex, 0.2–0.5 mm long, glabrous, smooth; lamina lorate or narrowly oblong, 6–10 mm long, 0.9–1.4 mm wide; adaxial surface green, glabrous, ± smooth; abaxial surface white, densely hairy with sessile stellate hairs 0.2–0.3 mm across; margin tightly recurved to midrib concealing abaxial surface of lamina; apex obtuse or rounded, sometimes apiculate with short extension from midrib; base cuneate; midvein obscure or slightly raised adaxially, abaxially raised and angular, sparsely papillate; marginal glands absent or rarely present at base of lamina, 1 each side of midrib, c. 0.1 mm across, sessile. Inflorescences of a single flower, pedunculate, axillary; peduncles 0.5–2 mm long; bracts 5 or 6, persistent, oblong or narrowly ovate, 1–4 mm long, 0.5–0.9 mm wide, acute or obtuse to rounded at tip, glabrous except for scattered stellate hairs on abaxial surface. Male flowers sessile; calyx lobes 5, red, ovate or elliptic, 2.8–5.1 mm long, 2.2–2.7 mm wide, rounded at tip, glabrous except for scattered minute simple hairs on margin; androecium 2.7–3.5 mm long, c. 0.7 mm across; stamens 18–46; filaments 0.1–0.2 mm long; anthers 0.5–0.9 mm long. Female flowers sessile; calyx 5-lobed, of unknown colour when fresh; tube up to 0.4 mm long; lobes ± equal, erect, ovate to broadly ovate, 1.5–3.5 mm long, 1.5–1.8 mm wide, obtuse to rounded or sometimes acute at tip, glabrous, with margins fimbriate; petals absent; ovary ellipsoid, 1.1–1.4 mm long, 1–1.3 mm across, 3-locular, glabrous, minutely verrucose; style with glabrous column c. 0.2 mm long and 3 spreading limbs; limbs yellow-green, 1.1–1.5 mm long, 0.7–0.8 mm wide, deeply 2– to 4–lobed; lobes 0.9–1.1 mm long, 0.3–0.4 mm wide. Capsule ovoid, 6–7 mm long, 3.2–3.5 mm across, glabrous, usually 1–3-seeded; persistent calyx lobes ≤ half the capsule length. Seed ellipsoid or obloid, 3.0–4.5 mm long, 2.3–2.4 mm wide, 2.0–2.4 mm across, light brown and mottled with dark brown; caruncle somewhat pyramidal or disk-like, 1.3–1.8 mm across, 0.2–1 mm long, yellowish-white.

***Selected specimens (from 35 examined)*: Western Australia.** 11 miles [c. 18 km] N of Cundeelee, Jun 1970, *Allan* 274 (AD, MEL, PERTH); *ditto*, Jun 1970, *Allan* 275 (MEL, PERTH); vicinity of Perkolilli Waterhole, Jun 1975, *Beard* 7406 (PERTH); Cundeelee, in 1967, *Boswell* H44 (PERTH); 14 km W of Menzies, Jul 1995, *Cranfield* 9887 (CANB); Coolgardie, in 1901, *Diels* (MEL); "Painted Cliffs", 50 km E of Lake Cronin crossroads, Aug 1980, *George* 15828 (PERTH); Queen Victoria Spring, Sep 1963, *George* 5872 (PERTH); 20 or 25 miles [32 or 40 km] S of Norseman, Oct 1963, *Jefferies* 631015A (K, PERTH); 54 miles [c. 87 km] E of Southern Cross, Oct 1963, *Jefferies* 631009 (K, PERTH); 124 miles [c. 200 km] E of Merredin, Oct 1964, *Jefferies* 641009 (PERTH); 54 miles [c. 87 km] E of Southern Cross, Oct 1963, *Jefferies* 631010 (K, PERTH); 5.2 km W of Zanthus, Oct 1986, *Keighery & Alford* 918 (PERTH); c. 50 m SW of Bushfire Rock Road, 46.5 km E of Hyden, Apr 1991, *Mollemans* 4625 (BRI); 7 miles [c. 11 km] N of Cundeelee, Oct 1956, *Royce* 5508 (PERTH); Queen Victoria Spring, N of Zanthus, Oct 1956, *Royce* 5518 (PERTH); 16 km NE of Gindalbie Homestead, about 70 km NNE of Kalgoorlie, Aug 1968, *Wilson* 7535 (BRI, PERTH); *ditto*, Aug 1968, *Wilson* 7536 (BRI, PERTH); 45 km N of Coolgardie, Oct 1974, *Wittwer* 1353 (PERTH).

***Distribution and habitat*:** *Bertya dimerostigma* is confined to the south-west of Western Australia, from the Merredin and Hyden districts eastward to near Zanthus (Map 7). It grows in hummock grassland, mallee with a tall shrubland understorey, open woodland or open shrubland communities, on white, yellow or red sandy soils often overlying pale grey or red clays.

***Phenology*:** Flowers and fruits have been recorded mostly from June to November, with a few records from January and April.

***Notes*:** The Jefferies (*Jefferies* 631010 (PERTH) and *Jefferies* 631015a (PERTH)) and Mollemans (*Mollemans* 4625 (BRI)) collections cited above differ from other specimens of *B. dimerostigma* seen in having subglobose seeds with a disk-like caruncle rather than obloid seeds with a pyramidal caruncle which are typical for this species. Further collections and field studies are warranted to establish the significance of these differences.

5. Bertya ernestiana Halford & R.J.F.Hend., **sp. nov.** arte affinis *B. pedicellatae* F.Muell. ut videtur sed statura breviore

(ad 1.5 m non 6 m alta), caulibus glabris pustulatis non stellato-pubescentibus, calycis lobis minus quam dimidium non plus quam dimidium longitudinem capsulae, et floribus ut videtur semper solitariis in quaque inflorescentia differt. **Typus:** Queensland. MORETON DISTRICT: Mt Ernest, Mt Barney National Park, 26 September 1999, *D.A. Halford* Q3801 (holo: BRI; iso: K, MEL, NSW, distribuendi).

Bertya sp. (Mt Ernest G.Leiper AQ507685), Forster & Halford (2002, p. 69).

Monoecious, much branched shrubs up to 1.5 m high, thinly viscid on young shoots and buds. Branchlets angular, glabrous, sparsely pustulate. Leaves petiolate, spirally alternate, spreading; petiole bi-convex, 2–4 mm long, glabrous, smooth; lamina linear to linear-elliptic, 40–80 mm long, 3–6 mm wide; adaxial surface green, glabrous except for isolated minute peltate scales, smooth, viscid; abaxial surface white, densely hairy with sessile stellate hairs up to 0.3 mm across; margin slightly recurved; apex acute, ultimately apiculate with pale brown extension from midrib c. 0.1 mm long terminated by a small gland; base attenuate; midvein slightly impressed adaxially, abaxially raised and angular, glabrous and smooth on abaxial face, stellate-pubescent laterally; marginal glands sometimes present at base of lamina, 1 each side of midrib, c. 0.1mm across, stipitate with stipe 0.1–0.2 mm long. Inflorescences of a single flower, pedunculate, axillary or sometimes terminal on rudimentary, short branchlet in distal leaf axils; peduncles 1–5 mm long; bracts 4–6, persistent but deciduous before the fruit matures, linear or narrowly triangular, 2–10 mm long, 0.3–1.3 mm wide, acute, obtuse or rounded at tip, glabrous or stellate-pubescent abaxially, glabrous adaxially. Male flowers sessile; calyx lobes 5, light green, ovate or oblong-ovate, 5.2–5.5 mm long, 2.6–3.5 mm wide, rounded at tip, glabrous; androecium 6.0–7.0 mm long, 0.9–1.0 mm across; stamens c. 60; filaments up to 0.2 mm long; anthers 0.8–1.1 mm long. Female flowers pedicellate; pedicels 1.0–2.1 mm long in flower, to 4.0 mm long in fruit, glabrous; calyx 5-lobed, light green coloured; tube c. 0.3 mm long; lobes ± equal, erect and revolute distally, narrowly oblong-ovate, 3.7–4.5 mm long, 1.0–1.5 mm wide, acute to rounded at tip, glabrous, with margins entire; petals absent or rudimentary where narrowly ovate, up to 0.8 mm long and 0.1 mm wide, glabrous; ovary ovoid, 1.3–2.0 mm long, 0.8–1.3 mm across, 3(rarely 4)-locular, glabrous, smooth; style with glabrous column 0.2–0.3 mm long and 3 spreading limbs; limbs yellow-green to red, 2.9–4.1 mm long, 0.6–0.7 mm wide, deeply 3– to 5-lobed; lobes 3.0–4.1 mm long, 0.2–0.3 mm wide. Capsule narrowly ellipsoid to narrowly ovoid, 7.5–10 mm long, 3.8–4.2 mm across, glabrous, usually 1-seeded; persistent calyx lobes ≤ half the capsule length. Seed obloid-ellipsoid, c. 6 mm long, c. 3.2 mm wide, c. 3 mm across, light brown; caruncle pyramidal, 2.2–2.4 mm across, 2.3–2.4 mm long, creamy-white. Fig. 2.

***Additional specimens examined*: Queensland.** MORETON DISTRICT: Mt Ernest, Apr 1993, *Forster & Leiper* PIF13258 (BRI); *ditto*, Sep 1991, *Leiper* (BRI, NSW); *ditto*, Jul 1992 *Leiper* (BRI).

***Distribution and habitat*:** *Bertya ernestiana* is known only from Mount Ernest in the south-east of Queensland (Map 8). It grows on skeletal sandy loam soils derived from rhyolite on steep rocky slopes and rock pavements in heath or open eucalypt forest with heath understorey.

***Phenology*:** Flowers and fruits have been recorded in April, July and September.

***Affinities*:** *Bertya ernestiana* seems most closely related to *B. pedicellata* but differs from that in its smaller stature, reaching only about 1.5 m high rather than up to 6 m high, its glabrous, pustulate rather than stellate-pubescent stems, and its calyx lobes being less than half the length of the capsule rather than exceeding half the length of the capsule. *B. ernestiana* also appears never to have more than one flower per inflorescence, whereas *B. pedicellata* sometimes has 2 flowers per inflorescence.

***Etymology*:** The specific epithet refers to Mount Ernest in south-east Queensland where the type for the species' name was collected.

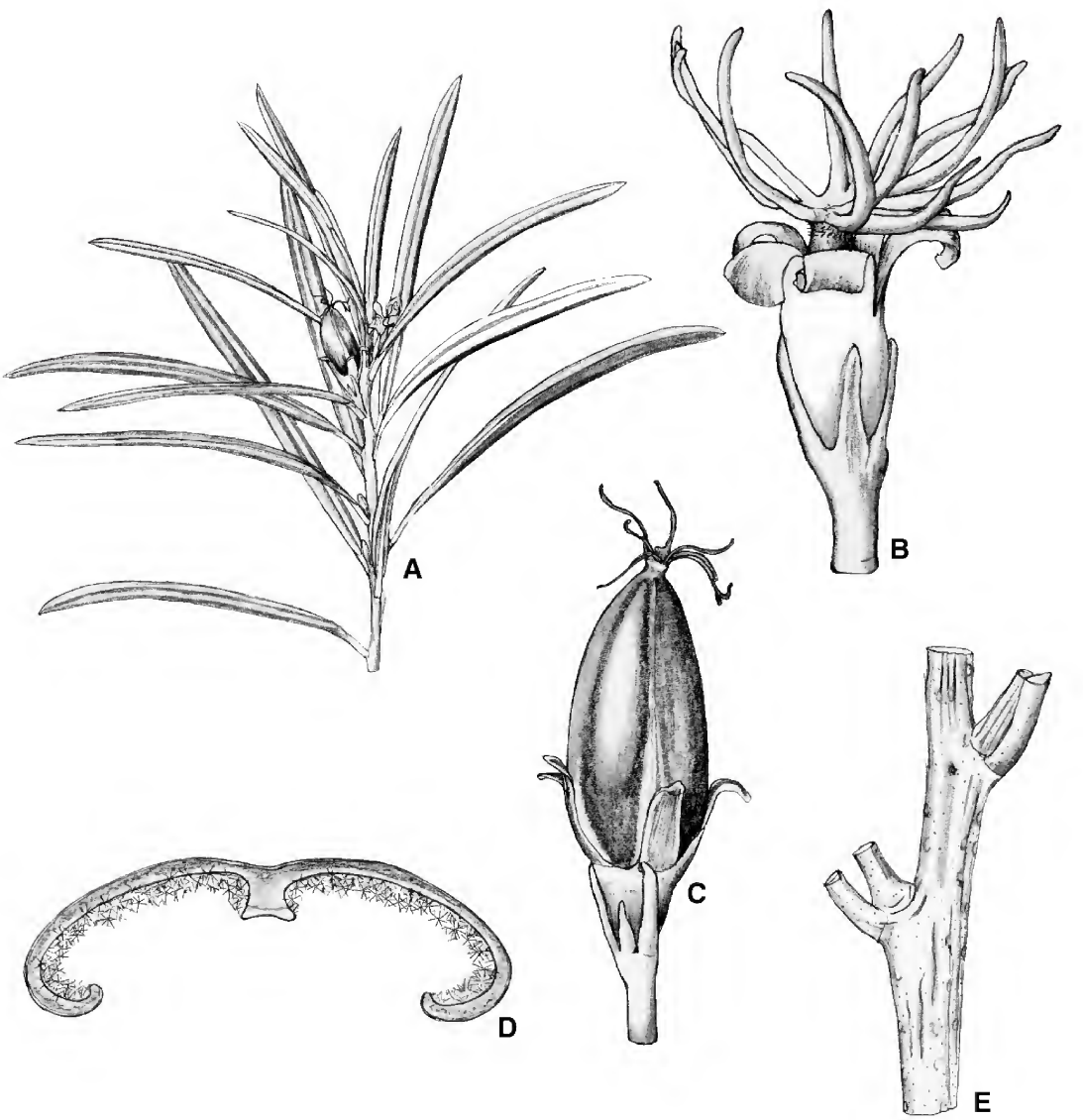


Fig. 2. ***Bertya ernestiana.*** A. branchlet with flowers and fruit. ×1. B. female flower from side. ×6. C. fruit from side. ×6. D. transverse section of leaf. ×18. E. section of branchlet. ×4. A–E from *Leiper* [AQ507685] (BRI). Del. W. Smith.

6. Bertya findlayi F.Muell., Fragm. 8: 141/142 (1874). **Type:** [Australia.] Upper Hume River, Jan 1874, [*F. Mueller*] (lecto, here chosen: MEL [MEL114064]; isolecto: MEL [MEL114295], NSW [NSW194876]).

Monoecious (sometimes predominantly either female or male), much-branched shrubs up to 2 m high, viscid on flower buds and young shoot tips. Branchlets ± angular, becoming terete with age, with a dense indumentum of stellate hairs, becoming glabrous with age, though remaining minutely tuberculate by persistent hair bases; hairs ± sessile, pale golden-yellow, 0.1–0.4 mm across. Leaves petiolate, spirally alternate, spreading; petiole plano-convex, 1.5–3.5 mm long, glabrous and slightly longitudinally grooved adaxially, with a dense stellate-pubescent indumentum up to 0.1 mm thick abaxially; lamina narrowly oblong, narrowly obovate or lorate, 20–46 mm long, 4–9 mm wide; adaxial surface green, glabrous, smooth; abaxial surface white, densely hairy with ± sessile stellate hairs up to 0.4 across; margin recurved; apex obtuse, rounded or truncate, usually ultimately apiculate with minute yellowish coloured extension from mibrib, terminated by a small gland; base cuneate to attenuate; midvein impressed adaxially, abaxially raised, angular and stellate-pubescent on all surfaces; marginal glands present at base of lamina, 1 each side of midrib, c. 0.1 mm across, sessile. Inflorescences of a single flower or rarely umbelliform with 3 flowers, pedunculate, axillary or sometimes terminal on rudimentary, a short branchlet in distal leaf axils; peduncles 3–6 mm long; bracts 4 or 5, persistent; outer bracts narrowly ovate or triangular, 1.8–2.7 mm long, 0.8–1.1 mm wide, acute at tip, stellate-pubescent abaxially, glabrous adaxially; inner bracts broadly ovate to orbicular, 1.8–2.4 mm long, 1.5–2.4 mm wide, acuminate at tip, glabrous or stellate-pubescent along midline abaxially. Male flowers sessile; calyx lobes 5, light green, ovate, 3.5–4.6 mm long, 2.5–3.3 mm wide, obtuse to rounded at tip, glabrous; androecium c. 4 mm long, c. 0.8 mm across; stamens 35–41; filaments c. 0.1 mm long; anthers 0.9–1.1 mm long. Female flowers sessile; calyx 5-lobed, light green coloured; tube c. 0.5 mm long; lobes equal, erect, recurved to revolute distally, narrowly ovate or somewhat narrowly triangular, 4.2–4.6 mm long, 1.9–2.2 mm wide, acute at tip, glabrous, with margins entire; petals absent; ovary ellipsoid, 2.5–3 mm long, 1.9–2.2 mm across, 3-locular, with a moderately dense indumentum of stellate hairs distally; style with glabrous column 0.2–0.5 mm long and 3 spreading limbs; limbs red, 2.1–2.7 mm long, 0.5–0.6 mm wide, deeply 3-lobed; lobes 0.6–1.9 mm long, 0.1–0.2 mm wide. Capsule narrowly ovoid or ellipsoid, 7.5–9.3 mm long, 3.9–5.2 mm across, glabrous or with scattered stellate hairs distally, usually 1-seeded; persistent calyx lobes ≤ to half the capsule length. Seed obloid, 5.2–6.6 mm long, 3.2–4.1 mm wide, 2.7–3.4 mm across, brown and mottled with reddish brown and light brown; caruncle disk-like, c. 2.1 mm across, c. 1 mm long, yellowish-white. mountain Bertya

***Selected specimens (from 17 examined)*: New South Wales.** c. 500 m NNW of Alpine Way bridge, Swampy Plains River, Kosciusko National Park, Oct 1987, *Davies* 182 (CANB, NSW); *ditto*, Jan 1988, *Davies & Walton* 452 (CANB, NSW); Geehi River track above Pinnacle, Jan 1959, *Ford* (NSW); Geehi River track, Snowy River, Sep 1954, *Mueller & Phillips* 2223 (NSW); Khancoban Back Creek, Geehi region below S.M.A. camp, Jan 1961, *Phillips* (CANB, NSW); Bogoing Creek track, Geehi Region, Oct 1957, *Phillips & Roeder-Roitzsch* (NE); Jacobs (Tongaroo) River, near road bridge, Nov 1968, *Rogers* (MEL); Apline Way, c. 10 km SE from Khancoban, Feb 1992, *Walsh* 3412 (MEL); Barry Highway at Jacobs River Crossing, Snowy River Valley, Nov 1968, *Willis* (MEL). **Victoria.** Surveyor's Creek, just upstream from junction with Tin Mine Road, Oct 1982, *Frood* (MEL).

***Distribution and habitat*:** *Bertya findlayi* is confined to the south-east of New South Wales from Khancoban to the Snowy River, to the north-east of Victoria near Corryong (Map 9). It grows in wet or dry sclerophyll forest communities dominated by *Eucalyptus albens* Benth. and *Callitris* sp. on sandy loam soils along watercourses and in gullies.

***Phenology*:** Flowers have been recorded in September and October, fruits in October, November, January and February.

***Typification*:** Four sheets of probable type material of *Bertya findlayi* have been located. All sheets have the species name in Mueller's hand written on them. Two sheets are at MEL with one sheet each at K and NSW. Although all the material appears to be from the one

collection, the sheet at K is labelled "base of Mt Kosciuska" while the remaining sheets are labelled "Upper Hume River, January 1874". Sheet MEL114064 at MEL is chosen here as the lectotype as it is the most ample of these specimens.

7. Bertya glandulosa Grüning in A.Engler, Pflanzenr. H.58: 59 (1913). **Type:** [Queensland.] Wallangarra, Oct 1901, *J. Boorman* (holo: W; iso: NSW [NSW194893]).

Monoecious or dioecious, much branched shrubs up to 2 m high, thickly viscid on floral buds and leaf lamina margins, less so on adaxial lamina surface. Branchlets ± angular with a dense indumentum of stellate hairs; hairs sessile, straw-coloured, up to 0.5 mm across. Leaves petiolate, spirally alternate, ascending to spreading; petiole plano-convex, 1.6–3.1 mm long, with a dense stellate-pubescent indumentum up to 0.2 mm thick; lamina narrowly oblong to lorate or rarely narrowly obovate, 10–27 mm long, 1.5–3.2 mm wide; adaxial surface green with a sparse to moderately dense indumentum of stalked stellate hairs, glabrescent, tuberculate with persistent hair bases; abaxial surface white, densely hairy with ± sessile stellate hairs up to up to 0.3 mm across; margin revolute; apex obtuse to rounded, ultimately apiculate with an extension from midrib up to 0.1 mm long and terminated with a light brown to red gland; base shortly cuneate; midvein impressed adaxially, abaxially raised, angular and pubescent with sessile and stipitate stellate hairs; marginal glands present at base of lamina, 1 each side of midrib, 0.1–0.15 mm across, sessile or stipitate with stipes up to 0.2 mm long. Inflorescences of a single flower, pedunculate, axillary; peduncles up to 1.5 mm long; bracts 4–6, persistent but deciduous before fruit matures, narrowly ovate to ovate, 1.5–2.5 mm long, 0.5–0.9 mm wide, acute at tip, glabrous or stellate-pubescent abaxially, glabrous adaxially. Male flowers shortly pedicellate; pedicels 0.5–0.8 mm long, glabrous; calyx lobes 5, yellow-green, oblong-elliptic, 3.1–3.7 mm long, 1.8–2.1 mm wide, rounded at tip, glabrous; androecium 2.0–3.0 mm long, 0.4–0.5 mm across; stamens 25–30; filaments c. 0.1 mm long; anthers 0.7–0.9 mm long. Female flowers sessile; calyx 5-lobed, yellow-green coloured; tube 0.4–0.6 mm long; lobes ± equal, erect, recurved distally, ovate to oblong-ovate, 1.8–2.2 mm long, 0.7–1.2 mm wide, acute or obtuse to rounded at tip, glabrous, with margins entire; petals absent or rudimentary when up to 0.6 mm long and 0.3 mm wide, ovate, glabrous; ovary ellipsoid, 1.3–1.6 mm long, 1.4 mm across, 3-locular, densely stellate-pubescent; style with hairy column 0.1–0.2 mm long and 3 spreading limbs; limbs red, 1.3–3.4 mm long, deeply 3– to 5-lobed; lobes 1.1–3.2 mm long, 0.2–0.3 mm wide. Capsule narrowly ellipsoid, 7–8 mm long, 3.7–4.2 mm across, with a moderately dense indumentum stellate hairs, usually 1-seeded; persistent calyx lobes ≤ half the capsule length. Seed obloid-ellipsoid, 5.4–6.1 mm long, 3.6–3.9 mm wide, 3.3–3.8 mm across, dark red; caruncle pyramidal, 2.4–2.7 mm across, 1.1–1.4 mm long, creamy-white.

***Selected specimens (from 13 examined)*: Queensland.** DARLING DOWNS DISTRICT: Bald Mountain, SW section of Girraween National Park, Jan 1995, *Bean* 8222 (BRI); Wallangarra, Oct 1901, *Boorman* (NSW); Wyberba, Portion 90, Jan 1993, *Forster & Halford* PIF12631 (BRI); *ditto*, Sep 1993, *Forster & Bean* PIF13850 (BRI); 3.3 km SE of Glen Aplin, Sep 1974, *Gittins* 2794 (BRI); ridge S of Bald Mountain, Girraween National Park, Sep 1994, *Grimshaw & Turpin* PG971 (BRI); 6 km W of Glen Aplin, portion 87, Stalling Lane, Jun 1994, *Halford & Grimshaw* Q2192 (BRI, NSW); 18 km SW of Stanthorpe, Oct 1994, *Halford* Q2293C (BRI); Mt Norman, c. 5 miles [8 km] NE of Wallangarra, Dec 1970, *Hockings* (BRI).

***Distribution and habitat*:** *Bertya glandulosa* is confined to the Stanthorpe-Wallangarra area in the south-east of Queensland (Map 10). It is recorded as growing in open eucalypt woodland, eucalypt/*Callitris* woodland or dense to open shrubland communities on shallow sandy soils on granite rock pavements and between granite boulders.

***Phenology*:** Flowers have been recorded in January, June, August to October and December, fruits in January and June.

***Affinities*:** *Bertya glandulosa* is somewhat similar in stature and leaf size to *B. oblonga* with which it has been confused in the past. *B. glandulosa* differs from *B. oblonga* by having a sparse to moderately dense indumentum on the adaxial surface of young leaf laminas, and ovate to oblong-ovate rather

than narrowly triangular calyx lobes in female flowers which are glabrous rather than stellate-pubescent on the abaxial surface.

***Notes*:** A Grieves collection from 'Whiteman Creek', just N of Grafton (*Grieves* [NSW194912] (NSW)), is noted here because it is similar to *B. glandulosa* in that it has a moderately dense rusty-brown indumentum of coarse stellate hairs on its branchlets and its adaxial leaf lamina surface is sparsely tuberculate from persistent hair bases. However, it differs by having linear leaves (about 30 mm long × 1.5 mm wide), with margins revolute to the midrib. Even from this single specimen, it is clear that the entity it represents warrants formal recognition. However, study of more collections of it are required before this can be undertaken.

8. Bertya grampiana Halford & R.J.F.Hend. **sp. nov**. arte affinis *B. findlayi* F.Muell. sed ramulorum indumento longiore et molliore, foliis petiolis brevioribus (0.9–1.5 mm non 1.5–3.5 mm longis), et laminis marginibus plus recurvis et plus attenuatis ad basem et apicem, floribus femineis pedicellatis non sessilibus in pedunculis brevioribus (1–4 mm non 3–6 mm longis), calycis lobis parvioribus (2.8–3.2 × 0.8–1.2 mm non 4.2–4.6 × 1.9–2.2 mm) et fructu parviore (6.7–7.3 × 3.2–3.6 mm non 7.5–9.3 × 3.9–5.2 mm) differt. In additamentis haec species affinis *B. ingramii* T.A.James sed pilis grossioribus in ramulis, foliis petiolis brevioribus (0.9–1.5 mm non 2.1–3.2 mm longis), et laminis laevibus non minute tuberculatis adaxialiter, et floribus femineis calycis lobis longioribus (2.8–3.2 mm non 1.5–2.2 mm longis) et ovario plus minusve glabro non dense stellato-pubescentibus differt. **Typus:** Victoria. Grampians, W foot of Victoria Range, Deep Creek, c. 0.5 miles [0.8 km] S from Cave of Hands, 11 November 1974, *J.H. Willis* (holo: MEL [MEL612505]).

***Illustration*:** L. Costermans (1986: p. 211) as *Bertya findlayi*.

Monoecious, much branched shrubs up to 4 m high, viscid on young shoots, flower buds and adaxial leaf lamina surfaces. Branchlets ± terete, with a dense indumentum of stellate hairs, becoming glabrous with age though remaining minutely tuberculate by persistent hair bases; hairs sessile or stipitate, white, 0.4–0.6 mm across, with stipes 0.3–0.5 mm long. Leaves petiolate, spirally alternate, spreading; petiole plano-convex, 0.9–1.5 mm long, glabrous and slightly grooved adaxially, with a dense stellate-pubescent indumentum up to 0.3 mm thick abaxially; lamina lorate, linear-obovate or narrowly obovate, 19–39 mm long, 2.5–4.4 mm wide; adaxial surface green, glabrous, smooth; abaxial surface white, densely hairy with sessile or shortly stipitate stellate hairs 0.2–0.5 mm across; margin recurved; apex acute to obtuse; base attenuate to cuneate; midvein impressed adaxially, abaxially raised, rounded, stellate-pubescent on all surfaces; marginal glands present at base of lamina, 1 each side of midrib, c. 0.1 mm across, sessile. Inflorescences of a single flower, pedunculate, axillary or terminal on a rudimentary, short branchlet in distal leaf axils; peduncles 1-4 mm long; bracts 5–7, persistent, narrowly ovate or narrowly triangular, 1–3.5 mm long, 0.3–1.5 mm wide, acute at tip, stellate-pubescent or glabrous abaxially, glabrous adaxially. Male flowers sessile or shortly pedicellate with pedicels up to 0.5 mm long, glabrous; calyx lobes 5, light green, ovate or ovate-elliptic, 4.7–5.1 mm long, 2.4–2.6 mm wide, obtuse to rounded at tip, glabrous; androecium 3.7–6.2 mm long, 0.3–0.6 mm across; stamens 43–49; filaments 0.1–0.3 mm long; anthers 0.9–1.1 mm long. Female flowers pedicellate; pedicels 0.3–1.1 mm long, glabrous; calyx 5(rarely 6)-lobed, light green coloured; tube c. 0.3 mm long; lobes equal, erect or sometimes spreading distally, narrowly ovate or narrowly triangular, 2.8–3.2 mm long, 0.8–1.2 mm wide, acute or obtuse at tip, glabrous, with margins entire; petals absent; ovary ellipsoid distally, 1.6–2.0 mm long, 1.1–1.5 mm across, 3-locular, glabrous or with scattered stellate hairs, smooth or sometimes verrucose; style with glabrous column 0.2–0.4 mm long and 3 spreading limbs; limbs red, 1.8–3.1 mm long, 0.3–0.8 mm wide, deeply 2– to 5-lobed; lobes 0.9–1.5 mm long, 0.1–0.2 mm wide. Capsule narrowly ellipsoid, 6.7–7.3 mm long, 3.2–3.6 mm across, glabrous or with scattered stellate hairs, usually 1-seeded; persistent calyx lobes ≤ half the capsule length.

Seed obloid, 5.5–5.7 mm long, 2.6–2.9 mm wide, 2.5–2.6 mm across, grey-white to light brown and mottled with dark brown; caruncle hemispherical, 1.6–1.9 mm across, 1–1.2 mm long, yellowish-white. mountain Bertya Fig. 3.

***Additional specimens*: Victoria.** Deep Creek, Billywing area, Victoria Range, Jan 1969, *Beauglehole* ACB30288 (MEL); *ditto*, Feb 1959, *Beauglehole* ACB4815 (MEL, NSW); Deep Creek, Victoria Range, Feb 1960, *Beauglehole* ACB4983 (CANB, MEL); Deep Creek, W side of Victoria Range, Apr 1957, *Beauglehole et al.* ACB4099 (AD, MEL); beside Deep Creek, W side of Victoria Range, Feb 1957, *Finck & Beauglehole* ACB4051 (MEL); Grampians National Park, Victoria Range, Deep Creek, Oct 1993, *Read* (MEL); Deep Creek, Victoria Range, Sep 1981, *Scarlett* 81-108 (CANB); 9 km SE of Glenisla, Deep Creek, Victoria Range, Sep 1981, *Scarlett* 81-107 (CANB); Deep Creek, Western Victoria Range, Oct 1988, *Westaway* 553 (MEL); west foot of Victoria Range, Deep Creek c. 0.5 miles [0.8 km] S from Cave of Hands, Nov 1974, *Willis* (MEL); Deep Creek, 5.5 miles [c. 9 km] SE of Glenisla, Jan 1964, *Willis* (MEL).

***Distribution and habitat*:** *Bertya grampiana* is confined to the Victoria Range in The Grampians, western Victoria (Map 11). It grows in riparian shrubland communities on shallow dark grey fine sandy soils associated with sandstone outcropping.

***Phenology*:** Flowers have been recorded between September and February, fruits in November, January and February.

***Affinities*:** Specimens of *Bertya grampiana* have previously been misidentified as *B. findlayi* with which this species is closely allied. *B. grampiana* can be distinguished from *B. findlayi* by its longer and softer white indumentum on the branchlets, leaves with shorter petioles (0.9-1.5 mm compared with 1.5–3.5 mm long) and leaf laminas with more strongly recurved margins and more attenuate at base and tip, and shortly pedicellate rather than sessile female flowers on shorter peduncles (1–4 mm compared with 3–6 mm long), with smaller calyx lobes (2.8–3.2 × 0.8–1.2 mm compared with 4.2–4.6 × 1.9–2.2 mm), producing smaller fruit (6.7–7.3 × 3.2–3.6 mm compared with 7.5–9.3 × 3.9–5.2 mm). *B. grampiana* also resembles *B. ingramii* but differs from that in having coarser hairs on branchlets, leaves with shorter petioles (0.9–1.5 mm long compared with 2.1–3.2 mm long) and a smooth rather than minutely tuberculate adaxial leaf lamina surface, and female flowers with longer calyx lobes (2.8–3.2 mm long compared with 1.5–2.2 mm long) and a ± glabrous rather than a densely stellate-pubescent ovary.

***Etymology*:** The specific epithet is derived from The Grampians area in Victoria where this species occurs.

9. Bertya granitica Halford & R.J.F.Hend. **sp. nov.** arte affinis *B. pinifoliae* Planch. ut videtur sed foliis laminis brevioribus et proportione latioribus (l/w ratio 25:1 non 30:1), floribus femineis calycis lobis majoribus (3.0–5.0 × 1.7–3.0 mm non 2.9–3.6 × 1.3–1.9 mm), fructibus majoribus (8.1–9.0 × 4.5–5.0 mm non 7.0–7.5 × 3.2–3.5 mm), et seminibus majoribus (6.5–6.7 × 3.6–3.7 × 3.0–3.1 mm non 4.7–5.2 × 2.7–2.8 × 2.3–2.4 mm) differt. In additamentis haec species affinis *B. recurvatae* Halford & R.J.F.Hend. et *B. gummiferae* Planch. Ab illa foliis laminis non distaliter recurvatis et floribus femineis calycis lobis marginibus ciliatis non integris differt. Ab haec foliis laminis acutis glande apiculata ad apicem non rotundatis et glandem ad apicem carens differt. **Typus:** Queensland. Burnett District: Beeron Holding, 15 September 1999, P.I. *Forster & T. Ryan* PIF19607 (holo: BRI; iso: MEL, NSW, distribuendi).

Bertya sp. (Beeron Holding P.I.Forster+ PIF5753), Forster & Halford (2002, p. 69).

Monoecious or rarely dioecious, much branched shrubs to 1 m high, viscid on young shoots and flower buds. Branchlets somewhat angular, becoming ± terete with age, glabrous or rarely sparsely stellate-pubescent on young shoots, soon becoming glabrous, tuberculate; hairs stipitate, white, c. 1 mm across, with stipes up to 0.1 mm long. Leaves petiolate, spirally alternate, ascending to spreading; petiole plano-convex, 0.5–1.2 mm long, glabrous or with a sparse indumentum of stellate hairs, up to 0.1 mm thick, smooth or sparsely tuberculate; lamina linear, 20–45 mm long, 1.3–3 mm wide; adaxial surface bright green, sparsely stellate-pubescent when young,



Fig. 3. Type of ***Bertya grampiana***.

glabrescent, tuberculate; abaxial surface white, densely hairy with ± sessile stellate (up to 0.6 mm across) and simple glandular (up to 0.05 mm long) hairs; margin recurved or revolute to midrib concealing lower leaf surface; apex subacute to obtuse, ultimately apiculate with extension from midrib up to 0.1 mm long, terminated with small brown gland; base cuneate; midvein impressed adaxially (sometimes only proximally), abaxially raised and angular, with stellate hairs on abaxial face, becoming glabrous, tuberculate with persistent hair bases, stellate-pubescent laterally; marginal glands present at base of lamina, 1 each side of midrib, 0.3–0.4 mm across, sessile. Inflorescences mostly of a single flower or sometimes umbelliform with 2 flowers, pedunculate, axillary; peduncles 0.3–1.5 mm long; bracts 3–7, persistent, narrowly ovate to ovate, 1.9–2.8 mm long, 0.6–1.5 mm wide, acute to obtuse at tip, glabrous, papillose. Male flowers sessile; calyx lobes 5, yellowish coloured, elliptic to oblong-elliptic, 3.4–4.5 mm long, 2–3 mm wide, rounded at tip, glabrous or sometimes with scattered simple hairs on margin; androecium 3.2–5.5 mm long, 0.6–0.8 mm across; stamens 40–50; filaments 0.1–0.2 mm long; anthers 0.8–1.1 mm long. Female flowers sessile; calyx 5-lobed, yellow-green; tube c. 0.5 mm long; lobes ± equal, erect, elliptic or oblong-elliptic, 3–5 mm long in flower, up to 9 mm long in fruit, 1.7–3.0 mm wide, rounded at tip, glabrous, with margins fimbriate; petals rudimentary, up to 0.5 mm long and 0.3 mm wide, ovate, glabrous; ovary ovoid, 1.3–1.8 mm long, 1.1–1.6 mm across, 3-locular, glabrous or with scattered stellate hairs distally; style with ± glabrous column 0.5–1.0 mm long and 3 spreading limbs; limbs red, 2.8–4.5 mm long, c. 0.5 mm wide, deeply 3– or 4-lobed; lobes 1.0–3.3 mm long, 0.2–0.3 mm wide. Capsule ovoid, 8.1–9 mm long, 4.5–5 mm across, glabrous or with scattered stellate hairs, usually 1-seeded; persistent calyx lobes usually longer than capsule. Seed obloid, 6.5–6.7 mm long, 3.6–3.7 mm wide, 3–3.1 mm across, brown; caruncle pyramidal, 2.4–2.5 mm across, 1.5–1.8 mm long, creamy-white. Fig. 4.

***Additional specimens*: Queensland.** BURNETT DISTRICT: Beeron Holding, 6 km W of "Toondahra" homestead, Sep 1989, *Forster* & *Bean* PIF5753 (BRI); *ditto,* Sep 1999, *Forster et al.* PIF24880 (BRI); 'Rocky Paddock', 47.7 km SW of Gayndah, Aug 1993, *Halford* Q1789 (BRI); *ditto*, Aug 1993, *Halford* Q1788 (BRI, MEL); Beeron Holding, 43 km S of Mundubbera, Aug 1996, *Halford* Q2906 (BRI); *ditto*, Aug 1996, *Halford* Q2905 (BRI).

***Distribution and habitat*:** *Bertya granitica* is confined to the south-east of Queensland, where it is restricted to the Mundubbera district (Map 12). It grows on shallow sandy soils on exposed granite outcrops in open eucalypt forest or woodland communities.

***Phenology*:** Flowers have been recorded in August and September, fruits in October.

***Affinities*:** *Bertya granitica* seems most closely related to *B. pinifolia* but differs from that in its shorter and proportionally broader leaf laminas (leaf lamina length/width ratio 25:1 compared with 30:1), its generally larger calyx lobes in female flowers (3.0–5.0 × 1.7–3.0 mm compared with 2.9–3.6 × 1.3–1.9 mm), its larger capsules (8.1–9.0 × 4.5–5.0 mm compared with 7.0–7.5 × 3.2–3.5 mm) and its larger seeds (6.5–6.7 × 3.6–3.7 × 3.0–3.1 mm compared with 4.7–5.2 × 2.7–2.8 × 2.3–2.4 mm).

B. granitica is also similar to *B. recurvata* and *B. gummifera* but differs from the former in having ciliate rather than glabrous margins on calyx lobes of female flowers and leaf laminas not recurved distally. *B. granitica* differs from *B. gummifera* in having an acute leaf apex terminated by an apiculate gland rather than a rounded leaf apex that lacks a terminal glandular apiculum.

***Etymology*:** The specific epithet 'granitica' refers to exposed granite rock outcrops upon which this species is found.

10. Bertya gummifera Planch., London J. Bot. 4: 473, t. 16, fig. 6 (1845); *Bertya gummifera* Planch. var. *gummifera*, Müll.Arg., Flora 47(30): 471 (1864). **Type:** [New South Wales.] barren rocky cliffs, W from Wellington Valley, near Croker's Range, [in 1825,] *A. Cunningham* 49 (holo: K (ex herb. Hook.)).

Bertya polymorpha forma *mitchelliana* Baill., Adansonia 6: 299 (1866). **Type:** [New South Wales.] barren rocky cliffs, W from Wellington Valley, near

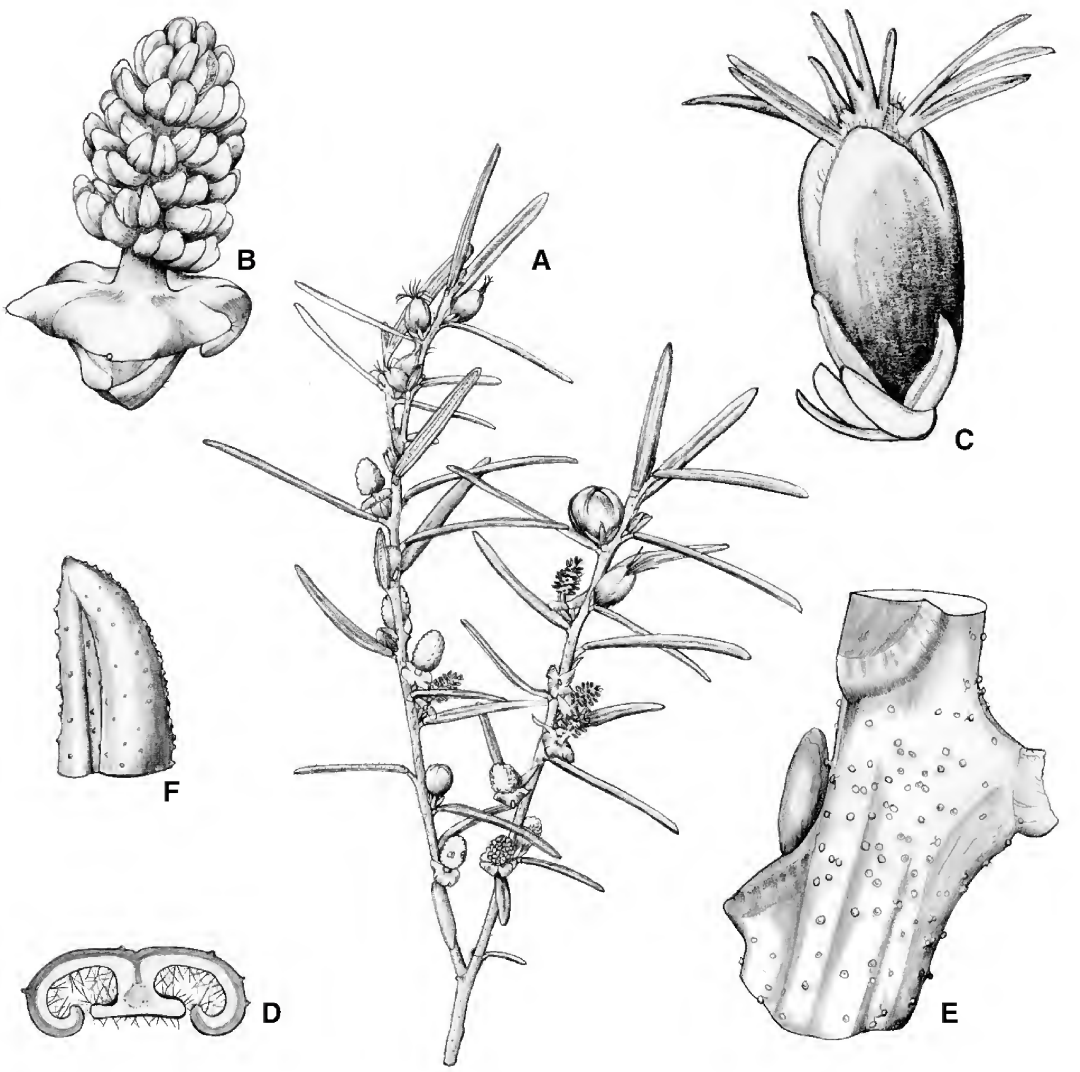


Fig. 4. ***Bertya granitica***. A. branchlet with flowers. ×1. B. male flower from side. ×6. C. female flower from side. ×6. D. transverse section of leaf. ×16. E. section of branchlet. ×24. F. oblique lateral view of leaf apex. ×16. A–C from *Forster et al.* PIF24880 (BRI); D, F from *Forster* & *Ryan* PIF19607 (BRI); E from *Forster* & *Bean* PIF5753 (BRI). Del. W. Smith.

Croker's Range, [in 1825,] *A. Cunningham* 49 (lecto, here chosen: K (ex herb. Hook.)).

Bertya neglecta Dümmer, J. Bot. 52: 151/152 (1914). **Type:** [New South Wales.] Barrens north of Arbuthnot's Range [Warrumbungle Ranges], [without date,] [*C.*] *Fraser* (holo: CGE *n.v.*, photo BRI).

Bertya gummifera var. *genuina* Müll.Arg., Flora 47(30): 471 (1864), *nom. inval.*

Monoecious (sometimes predominantly male or female), much branched shrubs to 2 m high, viscid on flower buds and flowers. Branchlets angular, becoming ± terete with age, with a moderately dense indumentum of stellate hairs, becoming glabrous with age though remaining coarsely tuberculate by persistent hair bases; hairs stipitate, white, up to 1.5 mm across, with stipes up to 0.4 mm long. Leaves petiolate, spirally alternate, ascending to spreading; petiole ± plano-convex, 1.4–1.9 mm long, with scattered stipitate stellate hairs up to 0.3 mm long; lamina linear, 10–30 mm long, 0.9–1.5 mm wide, recurved at tip; adaxial surface green, with moderately dense indumentum of stipitate stellate hairs, glabrescent, coarsely tuberculate with persistent hairs bases; abaxial surface white, densely hairy with stellate 0.3–0.6 mm across and simple glandular hairs up to 0.05 mm long; margin recurved or revolute to midrib concealing lower leaf lamina surface; apex rounded; base cuneate; midvein impressed adaxially, abaxially raised, angular, with scattered stipitate stellate hairs on abaxial face, stellate-pubescent laterally; marginal glands present at base of lamina, 1 each side of midrib, 0.2–0.3 mm across, sessile. Inflorescences of a single flower or umbelliform with 2 flowers, pedunculate, axillary; peduncles 1–1.5 mm long; bracts 5–8, persistent, narrowly ovate to narrowly ovate, 1.9–4 mm long, 0.9–1.9 mm wide, obtuse or acute at tip, sparsely stellate-pubescent or glabrous abaxially, glabrous adaxially. Male flowers pedicellate with pedicels up to 0.8 mm long, glabrous; calyx lobes 5, yellow-green with reddish blush on margin, elliptic to oblong-elliptic, 4.5–5.8 mm long, 3–4.3 mm wide, rounded at tip, glabrous except for scattered minute simple hairs on margin; androecium 5.5–6.5 mm long, 0.6–0.9 mm across; stamens 46–61; filaments 0.1–0.2 mm long; anthers 1–1.5 mm long. Female flowers sessile; calyx 5(rarely 6)-lobed, light green at anthesis, becoming dark red with age; tube up to 0.5 mm long; lobes equal, erect, elliptic or ovate, 3.8–6.2 mm long in flower, up to 10 mm long in fruit, 2.2–3.5 mm wide, rounded at tip, glabrous, with margins fimbriate; petals rudimentary, ovate, up to 0.6 mm long and 0.2 mm wide, glabrous; ovary subglobose or ovoid, 1.4–2.0 mm long, 1.4–1.6 mm across, 3-locular, glabrous; style with glabrous column 1.5–2.0 mm long and 3 spreading limbs; limbs pink to red, 4.9–8.2 mm long, 0.4–1.0 mm wide, deeply 3- or 4-lobed; lobes 3.8–6.2 mm long, 0.2–0.3 mm wide. Capsule ellipsoid, 6.9–9.2 mm long, 3–4.1 mm across, glabrous, usually 1-seeded; persistent calyx lobes > half the capsule length. Seed obloid, 5.3–7 mm long, 3.2–3.5 mm wide, 2.7–3 mm across, dark brown; caruncle pyramidal, 1.7–2.0 mm across, 0.8–1.0 mm long, creamy-white.

***Selected specimens (from 48 examined)*: New South Wales.** Dubbo-Mendooran road, Dec 1944, *Althofer* (NSW); Cobbora, May 1946, *Althofer* 86 (NSW); 3 miles [c. 5 km] ESE of Dewar, Goonoo State Forest, Aug 1955, *Biddiscombe* 341 (CANB); Rocky Glen, c. NE of Coonabarabran, Sep 1908, *Boorman* (NSW); Mt Dangar, Gungal, near Merriwa, Sep 1904, *Boorman* (AD, NSW); Denman, Jul 1907, *Cambage* (NSW); 3 miles [c. 5 km] NW of Sandy Hollow, Aug 1962, *Constable* 4023 (BRI, CANB, K, MEL, NSW); Cox's Gap, 6.9 km NNE of the Sandy Hollow-Muswellbrook Road via Wybong, Sep 1974, *Coveny & Jacobs* 5626 (K, NSW); 8 miles [c. 13 km] NW of Denman on road to Sandy Hollow, Oct 1970, *Fisher* 260 (BRI, CANB, NSW); c. 38 km SW of Dubbo on Newell Highway to Peak Hill in Momo State Forest, Sep 1989, *Henderson & Turpin* H3244 (BRI, NSW); *ditto*, Sep 1989, *Henderson & Turpin* H3245 (BRI, DNA, MEL, NSW); N side of Belougery Split Rock, Warrumbungle Mountains, Oct 1966, *Johnson & Briggs* 945 (NSW); 7 miles [c. 11 km] from Cobbora on Boomley road, Aug 1950, *Johnson & Constable* (K, NSW); Burbie Creek, Warrumbungle Range, 29 km W of Coonabarabran, Dec 1973, *Streimann* HS591 (BRI, CANB); Burbire Canyon, Warrambungles National Park, Aug 1984, *Walsh* 1318 (MEL, NSW); Pilliga Nature Reserve, 1 km from the Newell Highway on road to Yamimba Picnic area, Aug 1984, *Wiecek & Wannan* UNSW16477 (NSW); unnamed peak, 25-30 km N of Rylstone, Jul 1983, *Williams* 11 (NSW); 19 miles [c. 30 km] W of Coonabarabran, Oct 1971, *Williams* (NE).

***Distribution and habitat*:** *Bertya gummifera* occurs in central New South Wales in an area more or less bounded by Narrabri, Moonbi, Mt Dangar, Kandos, Dubbo and the Warrumbungle Ranges (Map 13). It is recorded from dry sclerophyll forest, low open woodland,

open mallee, shrubland or heathland communities on shallow sandy soils on rocky hillsides and ridges of sandstone, granite or trachyte. It is also recorded along rocky sandstone watercourses.

***Phenology*:** Flowers have been recorded from May to December, fruits from October to December.

***Affinities*:** *Bertya gummifera* seems most closely allied to *B. pinifolia, B. recurvata* and *B. granitica*. It differs from *B. pinifolia* in having proportionally shorter leaf laminas (leaf lamina length/width ratio less than 20:1 compared with greater than 30:1) and a rounded leaf apex that lacks a terminal apiculum compared with an acute leaf apex terminated by an apiculate gland. For features distinguishing *B. gummifera* from *B. recurvata* and *B. granitica* see notes under those species.

***Notes*:** Hunter's collection 2575 in BRI from Moore Creek Gap near Moonbi in New South Wales is presently included in, but is atypical of *B. gummifera* in that it is not as hairy on the branchlets and leaves and the leaves are generally smaller than those in the typical form of this species. Study of further collections is required to assess the significance of this variation.

11. Bertya ingramii T.A.James, Telopea 3(2): 285-286 (1988). **Type:** New South Wales. top of Dangar's Falls, SE of Armidale, Jan 1964, *J.B. Williams* K29 (holo: NSW; iso NE, *n.v.*, *fide* James *loc. cit.*).

Monoecious or apparently dioecious, much branched shrubs to 2.5 m high. Branchlets angular, becoming ± terete with age, with a dense indumentum of stellate hairs, becoming glabrous with age though remaining minutely tuberculate by persistent hair bases; hairs sessile or stipitate, white to grey-white, 0.1–0.2 mm across; stipes up to 0.2 mm long. Leaves petiolate, spirally alternate, spreading; petiole ± bi-convex, 2.1–3.2 mm long, with a dense stellate-pubescent indumentum up to 0.2 mm thick; lamina linear to lorate, linear-obovate or narrowly ovate, 22–37 mm long, 1.9–5 mm wide; adaxial surface dark green to grey-green, sparsely hairy with stipitate stellate hairs up to 0.1 mm across, glabrescent, minutely tuberculate with persistent hair bases; abaxial surface white, densely hairy with sessile and stipitate stellate hairs 0.1–0.2 mm across; margin recurved to revolute; apex obtuse to acute, rarely minutely apiculate; base cuneate to attenuate; midvein obscure, raised or rarely slightly impressed adaxially distally, abaxially raised, angular, stellate-pubescent on all surfaces; marginal glands present at base of lamina, 1 each side of midrib, 0.1–0.15 mm across, sessile. Inflorescences of a single flower or rarely umbelliform with 2 flowers, pedunculate, axillary; peduncles 0.9–1.5 mm long; bracts 6–10, persistent; outer bracts narrowly triangular or narrowly ovate, 1.6–3.8 mm long, 0.7–1.7 mm wide, acute at tip, stellate-pubescent on both surfaces; inner bracts ovate to broadly ovate, 1.4–1.8 mm long, 1.0–1.2 mm wide, obtuse at tip, glabrous. Male flowers sessile; calyx lobes 5, light green sometimes with a reddish blush distally, narrowly elliptic to elliptic or oblong-elliptic, 4.0–4.8 mm long, 2.5–3.2 mm wide, rounded at tip, glabrous or sometimes with scattered stellate hairs on margin; androecium 3.5–4.2 mm long, 0.6–0.7 mm across; stamens 34–46; filaments c. 0.1 mm long; anthers 0.9–1.4 mm long. Female flowers sessile; calyx 5-lobed, light green coloured; tube c. 0.5 mm long; lobes equal, erect to spreading, recurved distally, ovate to broadly ovate, 1.5–2.2 mm long, 1.1–1.6 mm wide, obtuse at tip, glabrous, with margins fimbriate; petals rudimentary, ovate or oblong, up to 0.4 mm long and 0.3 mm wide, glabrous; ovary subglobose, c. 1.6 mm long, c. 1.5 mm across, 3-locular, densely stellate-tomentose; style with hairy column 0.2–0.4 mm long and 3 spreading limbs; limbs red, 1.5–1.9 mm long, 0.4–0.5 mm wide, deeply 2– or 3-lobed; lobes 0.8–1.3 mm long, 0.3–0.5 mm wide. Capsule narrowly ovoid to ovoid, 7.5–10 mm long, 3.2–3.5 mm across, sparsely stellate-pubescent with long and short hairs, glabrescent, 1(sometimes 2)-seeded; persistent calyx lobes ≤ half the capsule length. Seed obloid or ellipsoid, 5.0–5.6 mm long, 2.9–3.3 mm wide, 2.8–3.0 mm across, light brown to brown; caruncle pyramidal, 2.0–2.1 mm across, 1.0–1.7 mm long, yellowish-white coloured.

***Selected specimens (from 12 examined)*: New South Wales.** near Mihi Falls, Oxley Wild Rivers National Park,

Sep 1997, *Copeland* 97-952 (NSW); top of Dangar's Falls, c. 300 m from carpark, Oxley Wild Rivers National Park, Dec 1996, *Davies & Johnstone* 49 (NSW); Dangar's Falls, c. 20 km S of Armidale, Sep 1976, *Hassall* 7667 (BRI); Dangar's Falls, c. 21 km S of Armidale, Oxley Wild Rivers National Park, Sep 1990, *Henderson & Turpin* H3405 (BRI); *ditto*, Sep 1990, *Henderson & Turpin* H3404 (BRI); Gara River, via Armidale, Oct 1936, *Ingram* (NSW); Dangar's Falls, Armidale, Sep 1971, *McBarron* 20294 (NSW); top of Dangar's Falls, near Armidale, Oct 1959, *Williams* G60 (NSW); *ditto*, Jan 1964 *Williams* K29 (NSW); *ditto*, Aug 1966, *Williams* (BRI, NE); Mihi Falls, c. 20 km E of Armidale, Aug 1989, *Williams* (BRI).

***Distribution and habitat*:** *Bertya ingramii* is confined to the Oxley Wild Rivers National Park near Armidale, in northern New South Wales (Map 14). It is recorded from dense heathland and shrubland communities on shallow loamy soils at cliff edges and in crevices on cliff-faces.

***Phenology*:** Flowers have been recorded from August to October, fruits in January.

***Affinities*:** *Bertya ingramii* resembles *B. polystigma* but can be distinguished from that by its finer indumentum on branchlets, its minutely tuberculate upper leaf lamina surface and its ovate to broadly ovate calyx lobes in female flowers. It also resembles *B. grampiana*. For distinguishing characters refer to notes under *B. grampiana.*

12. Bertya lapicola Halford & R.J.F.Hend. **sp. nov.** arte affinis *B. pedicellatae* F.Muell. ut videtur sed statura breviore (ad 2 m non ad 6 m alta), ramulis glabris non sparse stellato-pubescentibus, et foliis petiolis brevioribus (0.9–1.2 mm non 1.5–5.2 mm longis) et laminis omnino linearibus non lineari-obovatis vel lineari-ellipticis maximam partem differt. **Typus:** Queensland. MORETON DISTRICT: 4 km along Goldmine Road, 12 km N of Helidon, 12 April 1992, *L.H. Bird & D. Schreiber* (holo: BRI [AQ542245]; iso: K, NSW).

Monoecious, much branched shrubs up to 2 m high, thinly viscid on most parts. Branchlets angular, becoming terete with age, glabrous. Leaves petiolate, spirally alternate, ascending to spreading; petiole plano-convex, 0.9–1.2 mm long, glabrous, smooth; lamina linear, 15–55 mm long, 1.3–1.9 mm wide; adaxial surface green, glabrous, ± smooth, sometimes punctate in dried state; abaxial surface white, densely hairy with sessile stellate hairs 0.4–0.9 mm across; margin recurved to midrib usually concealing abaxial lamina surface; apex acute, ultimately apiculate with extension from midrib up to 0.2 mm long and terminated by a small brownish coloured gland; base obtuse; midvein impressed adaxially, abaxially raised, angular, glabrous and smooth on abaxial face, stellate-pubescent laterally; marginal glands present at base of lamina, 1 each side of midrib, 0.1–0.2 mm across, sessile or stipitate with stipes up to 0.2 mm long. Inflorescences of a single flower, pedunculate, axillary or terminal on a rudimentary, short branchlet in distal leaf axils; peduncles 1–6 mm long; bracts 2–5, persistent, linear-ovate or lorate, 0.8–2.6(–7) mm long, 0.4–0.5(–1) mm wide, acute at tip, glabrous. Male flowers sessile or pedicellate with pedicels up to 2 mm long, glabrous; calyx lobes 5, light green, elliptic or oblong-elliptic, 4–5.1 mm long, 2.1–3.5 mm wide, rounded at tip, glabrous; androecium 2.8–6 mm long, 0.7–0.8 mm across; stamens 55–77; filaments c. 0.1 mm long; anthers 0.8–1.2 mm long. Female flowers pedicellate; pedicels 2.8–4.0 mm long, glabrous; calyx 5-lobed, light green; tube c. 0.1 mm long; lobes equal, erect, recurved to revolute distally, linear-ovate or linear-oblong, 1.8–5.5 mm long, 0.6–1.1 mm wide, acute at tip, glabrous, with margins entire; petals absent; ovary narrowly ellipsoid, 1.8–2.5 mm long, 0.9–1.5 mm across, 3(rarely 5)-locular, glabrous, verrucose; style with glabrous column 0.8–1.3 mm long and 3 ascending limbs; limbs red, 3.5–6 mm long, 0.3–0.4 mm wide, deeply 2– or 3-lobed; lobes 1.5–4.1 mm long, 0.1–0.2 mm wide. Capsule narrowly ovoid or pyriform, 8.5–12 mm long, 4–5.5 mm across, glabrous, usually 1-seeded; persistent calyx lobes ≤ to half the capsule length. Seed obloid-ellipsoid or ellipsoid, 5.4-6.9 mm long, 2.9–3.7 mm wide, 2.8–3.5 mm across, light brown to dark brown; caruncle pyramidal, 1.4–2.0 mm across, 1.0–1.8 mm long, creamy-white.

***Affinities*:** *Bertya lapicola* seems closely related to *B. pedicellata* but can be distinguished from that by its smaller habit (up to 2 m compared with up to 6 m tall), glabrous rather than sparsely stellate-pubescent

branchlets, shorter petioles (0.9–1.2 mm long compared with 1.5–5.2 mm long) and linear rather than mostly linear-obovate or linear-elliptic leaf laminas.

***Etymology*:** The specific epithet is derived from Latin, *lapis* (stone) and *-cola* (-dweller), and refers to the rocky sandstone sites where this species occurs.

***Notes*:** This species is confined to the south-east of Queensland where it has disjunct populations within its overall distribution. Two subspecies are therefore recognized here.

Shrubs to 2 m high; leaf laminas (2.5)3.5–5.5 cm long; basi-laminar glands with stipes up to 0.2 mm long; peduncles of male flowers slender, 4–6 mm long. **12a. B. lapicola** subsp. **lapicola**

Shrubs to 1.5(rarely 2) m high; leaf laminas 1.5–3.0(4.0) cm long; basi-laminar glands sessile; peduncles of male flowers stout, 1–4 mm long. **12b. lapicola** subsp. **brevifolia**

12a. Bertya lapicola Halford & R.J.F.Hend. subsp. **lapicola**

Bertya sp. (Helidon Hills G.Leiper AQ457013), Forster & Halford (2002, p. 69).

For differences between subspecies see key above. Fig. 5.

***Additional specimens*:** **Queensland.** MORETON DISTRICT: Alice Creek, 7.5 km ESE of Murphys Creek rail siding, Aug 1990, *Forster & Bird* PIF7102 (BRI); Portion 43V, Parish of Helidon, Aug 1989, *Grimshaw* GS49 (BRI); White Mountain State Forest 564, 5 km NE of Murphys Creek township, Sep 1993, *Halford* Q1877 (BRI); Helidon Hills, c. 10 km NNW of Helidon township, Sep 1989, *Henderson & Guymer* H3234 (BRI); western end of David's road, on portion 43V, Helidon, Aug 1989, *Leiper* (BRI); Helidon Hills, high cliffs N of Paradise Creek, Sep 1993, *Sparshott & Sparshott* 110 (BRI).

***Distribution and habitat*:** *Bertya lapicola* subsp. *lapicola* is confined to the sandstone hills north of Helidon in south-east Queensland (Map 15). It is recorded from sandy soils on steep hill slopes or along cliff lines in open forest communities dominated by *Eucalyptus fibrosa* subsp. *nubila* (Maiden & Blakely) L.A.S.Johnson, *E. acmenoides* Schauer, *Corymbia henryi* (S.T.Blake) K.D.Hill & L.A.S.Johnson, *E. baileyana* F.Muell. and *Lysicarpus angustifolius* (Hook.) Druce.

***Phenology*:** Flowers have been collected from June to September, with one collection in April, fruits from April, August to October and December.

12b. Bertya lapicola subsp. **brevifolia** Halford & R.J.F.Hend. **subsp. nov.** ab *B. lapicola* Halford & R.J.F.Hend. subsp. *lapicola* foliis plerumque brevioribus (1.5–3.0(4.0) cm non (2.5)3.5–5 cm longis), glandibus ad basin laminarum sessilibus non stipitibus usque ad 0.2 mm longis et floribus masculinis pedunculis 1–4 mm longis et crassis non 4–6 mm longis et gracilibus differt. **Typus:** Queensland. LEICHHARDT DISTRICT: Salvator Rosa National Park, 170 km SW of Springsure, September 1987, *M.B. Thomas* 240 (holo: BRI).

Bertya sp. (Oakey Creek B.O'Keeffe 822), Forster & Halford (2002, p. 69).

For differences between subspecies see key above.

***Selected specimens (from 21 examined)*:** **Queensland.** LEICHHARDT DISTRICT: Pythagoras Mt, Salvator Rosa National Park, Oct 1981, *Ballingall & Cockburn* MEB426 (BRI); *ditto*, in 1984 *Ballingall* MEB1178 (BRI); just E of Planet Creek, Planet Downs, E of Rolleston, Oct 1998, *Bean* 14220 (BRI); Nathan Gorge, Oct 1989, *Bean* 1133 (BRI); Robinson Gorge National Park, Sep 1992, *Forster & Sharpe* PIF11360 (BRI, NSW); SW base of Shepherds Peak, Robinson Creek, Expedition National Park, Sep 1995, *Forster & Figg* PIF17762 (BRI); Nathan Gorge, SW of Cracow, Aug 1990, *Forster* PIF7165 (BRI); 2 miles [c. 3 km] N of Mt Playfair, Aug 1966, *Gittins* 1170 (NSW); Oakey Creek, Expedition Gully, Oct 1984, *O'Keeffe* 813 (BRI); *ditto*, Oct 1984, *O'Keeffe* 822 (BRI); *ditto*, Sep 1990, *O'Keeffe* 966 (BRI).

***Distribution and habitat*:** *Bertya lapicola* subsp. *brevifolia* is geographically disjunct

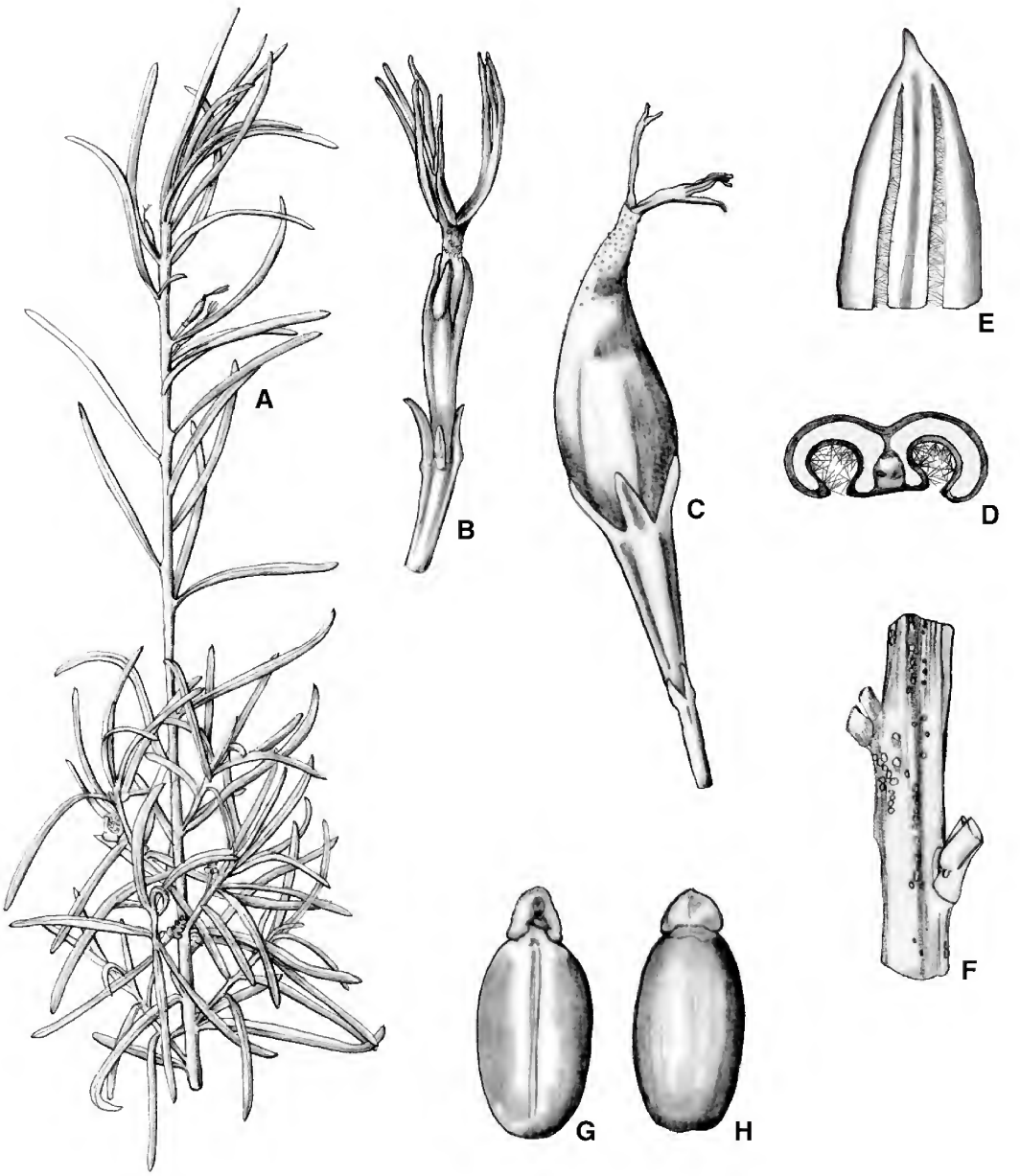


Fig. 5. ***Bertya lapicola*** subsp. ***lapicola***. A. branchlet with flowers. ×0.8. B. female flower from side. ×4. C. fruit from side. ×4. D. transverse section of leaf. ×16. E. abaxial view of leaf apex. ×16. F. section of branchlet. ×4. G. ventral view of seed. ×4. H. dorsal view of seed. ×4. A, C–H from *Henderson* & *Guymer* H3234 (BRI); B from *Forster* PIF7102 & *Bird* (BRI). Del. W. Smith.

from *B. lapicola* subsp. *lapicola* (Map 16). *B. lapicola* subsp. *brevifolia* is confined to the Carnarvon and Expedition Ranges, in the Springsure - Injune area of central Queensland. It grows in open eucalypt forest or open *Eucalyptus/Callitris* woodland communities associated with sandstone outcrops. The soils are generally recorded as shallow and sandy.

***Affinities*:** This subspecies differs from the other subspecies by its generally shorter leaves and stouter and shorter pedicels of the male flowers.

***Etymology*:** The subspecific epithet is from Latin *brevis* (short) and *-folius* (-leaved), and refers to the comparatively shorter leaves which characterize this subspecies.

13. Bertya linearifolia Halford & R.J.F.Hend. **sp. nov.** arte affinis *B. lapicola* Halford & R.J.F.Hend. ut videtur sed ramulis stellato-pubescentibus non glabris, foliis laminis 12–18 mm non 15–55 mm longis, et bracteis in inflorescentiis caducis non persistentibus differt. Nonnulla specimina *B. linearifoliae* pro *B. cunninghamii* Planch. determinata sed *B. linearifolia* differt ab *B. cunninghamii* floribus femineis pedicellis longioribus (2.5–5.0 mm non 0.3–1.0 mm longis), capsulis grandioribus (9–11 × 3.2–3.5 mm non 4.8–7.2 × 2.9–4.2 mm), et foliis ad apicem acutis et apiculo non rotundis, obtusis vel truncatis. **Typus:** New South Wales. Upper Baerami Valley, 30 km from Sandy Hollow, 17 July 1988, *C. Gibson & R. Miller* [NSW216894] (holo: NSW).

Monoecious, much branched shrubs, viscid on young shoots and branchlets. Branchlets angular, becoming terete with age, with a sparse indumentum of stellate hairs, glabrescent, sparsely tuberculate; hairs stipitate, white, 0.3–0.4 mm across, with stipes up to 0.1 mm long. Leaves petiolate, spirally alternate, ascending to spreading; petiole plano-convex, 1.0–1.5 mm long, glabrous, smooth; lamina linear, 12–18 mm long, 1.0–1.3 mm wide; adaxial surface green, glabrous, ± smooth; abaxial surface white, sparsely to densely hairy with sessile stellate hairs c. 0.1 mm across; margin recurved to midrib concealing abaxial surface; apex acute, ultimately apiculate by extension of midrib to 0.2 mm long terminated by a small brownish coloured gland; base cuneate; midvein obscured or slightly impressed adaxially, abaxially raised, angular, glabrous and smooth on abaxial face, stellate-pubescent laterally; marginal glands present at base of lamina, 1 each side of midrib, 0.1–0.3 mm across, sessile or stipitate with stipes up to 0.1 mm long. Inflorescences of a single flower, pedunculate, axillary or sometimes terminal on a rudimentary, short branchlet in distal leaf axils; peduncles 2–3 mm long; bracts 2–5, persistent or caducous, lorate, 1.0–1.8 mm long, 0.3–0.4 mm wide, rounded at tip, glabrous. Male flowers sessile or pedicellate with pedicels up to 1 mm long, glabrous; calyx lobes 5, of unknown colour when fresh, oblong-elliptic, 3.5–4.0 mm long, 2.0–2.3 mm wide, rounded at tip, glabrous; androecium 2.7–3.2 mm long, 0.4–0.5 mm across; stamens 25–35; filaments c. 0.1 mm long; anthers c. 0.6 mm long. Female flowers pedicellate; pedicels 2.5–5.0 mm long, glabrous; calyx 5-lobed, of unknown colour when fresh; tube c. 0.1 mm long; lobes equal, erect, linear-ovate or linear-oblong, c. 2.5 mm long, c. 1.0 mm wide, obtuse at tip, glabrous, with margins entire; petals absent; ovary narrowly ellipsoid, c. 2 mm long, c. 1 mm across, 3-locular, glabrous, smooth; style with glabrous column c. 1 mm long and 3 ascending limbs; limbs of unknown colour when fresh, 3.0–3.5 mm long, c. 0.3 mm wide, entire or deeply 2– or 3-lobed; lobes 1.5–3.5 mm long, 0.1–0.2 mm wide. Capsule narrowly ovoid or pyriform, 8.5–10 mm long, 3.2–5.2 mm across, glabrous, usually 1-seeded; persistent calyx ≤ half the capsule length. Seed not seen. Fig. 6 & 7.

***Additional specimen*:** **New South Wales.** Denman, Jul 1924, *Laseron* [NSW194999](NSW).

***Distribution and habitat*:** *Bertya linearifolia* is restricted the Denman - Sandy Hollow area in the Central Western Slopes of New South Wales (Map 17). It is recorded as growing on a ridge in association with *Eucalyptus* species, *Prostanthera cryptandroides* A.Cunn. ex Benth. and *Hemigenia cuneifolia* Benth.

***Phenology*:** Flowers and fruits have been recorded in July.

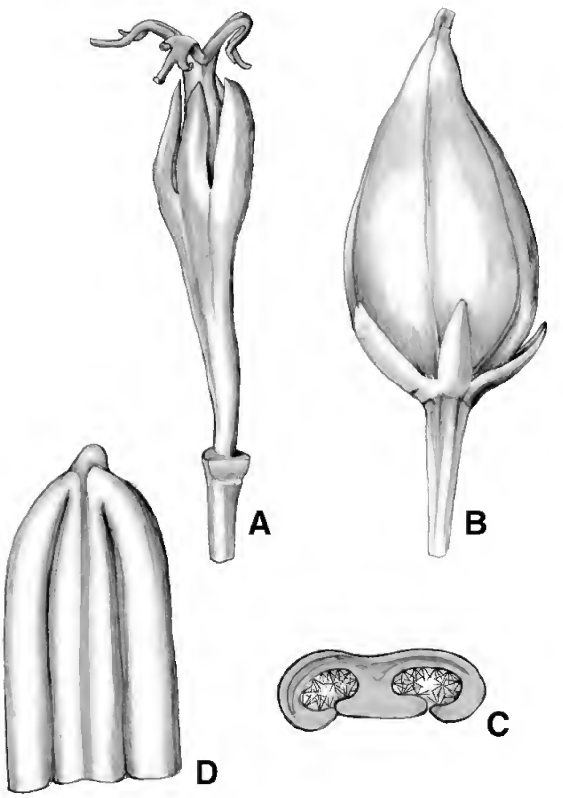


Fig. 6. ***Bertya linearifolia.*** A. female flower from side. ×6 . B. fruit from side. ×4. C. transverse section of leaf. ×16. D. abaxial view of leaf apex. ×16. A–D from *Gibson & Millar* [NSW216894] (NSW). Del. W. Smith.

***Affinities*:** *Bertya linearifolia* seems most closely related to *B. lapicola* from which it can be distinguished by having stellate-pubescent rather than glabrous branchlets, shorter leaf laminas (12–18 mm compared with 15–55 mm long) and caducous rather than persistent bracts.

Specimens of *B. linearifolia* have previously been identified as *B. cunninghamii* but can be distinguished from that by the longer pedicels on female flowers (2.5–5.0 mm long compared with 0.3–1.0 mm long), larger capsules (9–11 × 3.2–3.5 mm compared with 4.8–7.2 × 2.9–4.2 mm) and by the prominent apiculum at the leaf tips.

***Etymology*:** The specific epithet is derived from Latin *linearis* (linear) and *-folius* (-leaved), and refers to the linear leaves of the species.

14. Bertya mollissima Blakely, Contr. New South Wales Natl Herb. 1: 120 (1941). **Type:** [New South Wales.] Warrumbungle Ranges, October 1899, *W. Forsyth* (holo: NSW, photo BRI).

Monoecious (sometimes predominantly male or predominantly female), much branched shrubs up to 3 m high. Branchlets ± terete, with a moderately dense to dense indumentum of stellate hairs, becoming glabrous with age, though remaining tuberculate by persistent hair bases; hairs sessile or stipitate, straw-coloured to golden-yellow, 0.4–0.6 mm across; stipes up to 0.2 mm long. Leaves petiolate, spirally alternate, spreading; petiole ± plano-convex, 0.8–2.2 mm long, glabrous adaxially, with a moderately dense stellate-pubescent indumentum up to 0.2 mm thick abaxially; lamina linear to lorate, oblong or rarely narrowly elliptic, 6–24 mm long, 1.4–3.7 mm



Fig. 7. Type of ***Bertya linearifiolia*.**

wide; adaxial surface green, densely hairy with stipitate stellate hairs, 0.3–0.4 mm across, glabrescent, tuberculate with persistent hair bases; abaxial surface white, densely hairy with sessile and shortly stipitate stellate hairs 0.4–0.5 mm across; margin recurved; apex obtuse to rounded; base obtuse to cuneate; midvein impressed adaxially, abaxially raised and angular, stellate-pubescent with straw-coloured hairs on abaxial face and white hairs laterally; marginal glands absent or occasionally present at base of lamina when 1 each side of midrib, c. 0.1 mm across, stipitate with stipes 0.1–0.2 mm long. Inflorescences of a single flower, pedunculate, axillary; peduncles 1–1.6 mm long; bracts 5–7, persistent; ovate or linear-ovate, 1.5–3.2 mm long, 0.5–1.7 mm wide, acute at tip, stellate-pubescent abaxially, glabrous or stellate-pubescent distally adaxially. Male flowers sessile; calyx lobes 5, yellowish to brown, ovate, 3.1–4 mm long, 2.3–3.2 mm wide, obtuse to rounded at tip, stellate-pubescent abaxially; androecium 3.0–3.7 mm long, 0.5–0.8 mm across; stamens 36–63; filaments c. 0.1 mm long; anthers 0.7–0.8 mm long. Female flowers sessile; calyx 5-lobed, light green to grey-white; tube c. 0.5 mm long; lobes equal, erect, narrowly ovate to ovate, 2.0–2.7 mm long, 0.8–1.4 mm wide, acute at tip, densely stellate-pubescent abaxially, glabrous adaxially, with margins entire; petals absent; ovary ovoid, 1.6–2.0 mm long, 1.5–1.6 mm across, 3-locular, densely stellate-pubescent; style with hairy column 0.1–0.2 mm long and 3 spreading limbs; limbs red, 1.5–2.3 mm long, c. 0.4 mm wide, deeply 2– to 4-lobed; lobes 0.8–1.7 mm long, 0.1–0.2 mm wide. Capsule narrowly ellipsoid or narrowly ovoid, 5.5–7.6 mm long, 2.6–3.6 mm across, glabrous except for a sparse to moderately dense indumentum of stellate hairs distally, usually 1-seeded; persistent calyx lobes c. ¼ the capsule length. Seed ovoid, c. 5.2 mm long, c. 2.5 mm wide, c. 2.1 mm across, light brown; caruncle pyramidal, c. 1.1 mm across, c. 0.8 mm long, yellowish-white.

***Selected specimens (from 20 examined)*: New South Wales.** Mt Kaputar, Mt Kaputar National Park, Nov 1976, *Coveny* & *Roy* 8872 (NSW); Mt Kaputar National Park at West Kaputar Lookout, Aug 1987, *Coveny et al.* 12723 (BRI, MEL, NSW); 0.4 km NE of Burrumbuckle Rock, Warrumbungle Range, Oct 1978, *Crisp* 4404 (CANB); Mt Kaputar National Park, West Kaputar Rock, Nov 1993, *Forster* & *Machin* PIF14190 (BRI, NSW); Warrumbungle Ranges, Oct 1899, *Forsyth* (NSW); summit area of Mt Kaputar, Mt Kaputar National Park, Nov 1987, *Fox* 87/091 (CANB); Mt Kaputar, Sep 1976, *Hassall* 7670 (BRI); summit of Mt Kaputar, Mt Kaputar National Park, Oct 1990, *Henderson* & *Turpin* H3485 (BRI); *ditto*, Oct 1990, *Henderson* & *Turpin* H3487 (BRI); West Kaputar Rock Lookout, Mt Kaputar National Park, Oct 1990, *Henderson* & *Turpin* H3483 (BRI); *ditto*, Oct 1990, *Henderson* & *Turpin* H3484 (BRI); Mt Kaputar, Sep 1949, *Ingram* (NSW); peak of Mt Kaputar, Mt Kaputar National Park, Nov 1992, *Kennedy et al.* 469 (NSW); "Belmont", 42 miles [c. 67 km] E from Scone, Jun 1939, *Rupp* (BRI, NSW); near Mt Wombelong, Warrumbungle Range, Dec 1973, *Streimann* H5557 (CANB, NSW).

***Distribution and habitat*:** *Bertya mollissima* is confined to central New South Wales from Mt Kaputar, Warrumbungle and Liverpool Ranges to the Scone and Singleton districts (Map 18). It is recorded from rocky sites on steep hillsides and on mountain summits in open heath or open eucalypt woodland communities. Soils are shallow grey sandy or gravelly loams overlying basalt, trachyte or andesite.

***Phenology*:** Flowers have been recorded from September to December, with one record in June, fruits in December.

***Notes*:** Collections from Mt Kaputar (e.g. *Coveny et al.* 12723 (BRI, MEL, NSW), *Henderson* & *Turpin* H3485 (BRI)) have narrower leaves than do collections from other populations of the species. These may represent a distinct variety but study of further material from throughout the species' range would be needed to confirm this.

15. Bertya oblonga Blakely, Proc. Linn. Soc. New South Wales 54: 682, pl. 29 (1929). **Type:** [New South Wales.] Pinecliffe, 7 November 1907, *W.F. Blakely* (holo: NSW [NSW194889]; iso: MEL [MEL114086], K).

Bertya species D, James & Harden (1990, p. 416).

Monoecious or dioecious, intricately branched shrubs to 1.8 m high, viscid on adaxial leaf surfaces and flower buds. Branchlets ± terete, with a dense indumentum of stellate hairs; hairs sessile, pale straw-coloured or grey-white, up to 0.1 mm across. Leaves petiolate, spirally alternate, ascending to spreading; petiole plano-convex, 1.3–2.2 mm long, with a dense

stellate-pubescent indumentum up to 0.1 mm thick; lamina narrowly oblong to lorate or sometimes linear, 8–23 mm long, 1.3–3 mm wide; adaxial surface green, glabrous; abaxial surface white, densely hairy with ± sessile stellate hairs 0.1–0.2 mm across; margin flat to recurved or rarely revolute; apex rounded or obtuse; base obtuse; midvein impressed adaxially, abaxially slightly raised, rounded or slightly angular, with moderately dense indumentum of stellate hairs; marginal glands usually present at base of lamina, 1 each side of midrib, 0.1–0.15 mm across, sessile or stipitate with stipes up to 0.2 mm long. Inflorescences of a single, flower, pedunculate, axillary; peduncles 1.5–2.5 mm long; bracts 2–8, caducous or persistent; outer bracts narrowly triangular, narrowly ovate or oblong, 0.8–2.1 mm long, 0.6–1 mm wide, acute or obtuse at tip, stellate-pubescent abaxially, glabrous adaxially; inner bracts narrowly ovate, 1.3–1.6 mm long, 0.4–0.5 mm wide, acute at tip, glabrous or sparsely stellate-pubescent abaxially. Male flowers sessile or pedicellate with pedicels 0.4–1 mm long, stellate-pubescent; calyx lobes 5, yellow-green with a reddish blush distally, ovate or oblong-elliptic, 3.1–4.1 mm long, 1.7–2.7 mm wide, rounded at tip, glabrous; androecium 3.5–5.5 mm long, 0.4–0.6 mm across; stamens 31–43; filaments 0.1–0.5 mm long; anthers 1.0–1.4 mm long. Female flowers pedicellate; pedicels 0.4–1.2 mm long, densely stellate-pubescent; calyx 5-lobed, light green coloured; tube 0.3–0.5 mm long; lobes ± equal, erect, narrowly triangular, 1.5–2.0 mm long, 0.5–1.0 mm wide, acute at tip, sparsely to densely stellate-pubescent abaxially, glabrous adaxially, with margins entire; petals absent; ovary ellipsoid, 1.8–2.0 mm long, 1.7–1.8 mm across, 3-locular, densely stellate-pubescent; style with hairy column 0.1–0.3 mm long and 3 spreading limbs; limbs red, 1.5–3.1 mm long, 0.3–0.8 mm wide, deeply 3-lobed; lobes 0.7–2 mm long, 0.1–0.2 mm wide. Capsule ovoid-ellipsoid, 7.5–9 mm long, 3.9–4.8 mm across, with a sparse to moderately dense indumentum of stellate hairs, usually 1-seeded; persistent calyx lobes ≤ half the capsule length. Seed obloid, 4.5–6.0 mm long, 2.9–3.2 mm wide, 2.4–2.8 mm across, dark brown or reddish brown; caruncle pyramidal, 1.5–1.8 mm across, 0.8–1 mm long, yellowish-white.

***Selected specimens (from 27 examined)*: New South Wales.** The Gap, Cumnock, *Althofer* (NSW); Eurimbula Gap, near Larras Lee, in 1970, *Althofer* (NSW); The Gap, on Cumnock to Larras Lee road, NNW of Molong, Oct 1990, *Henderson & Turpin* H3480 (BRI); *ditto*, Sep 1989, *Henderson & Turpin* H3247 (BRI, NSW); *ditto*, Oct 1990, *Henderson & Turpin* H3481 (BRI); *ditto*, Sep 1989, *Henderson & Turpin* H3248 (BRI, NSW); near Pinecliffe, c. 10 km SW of Molong, Sep 1989, *Henderson & Turpin* H3249 (BRI, CANB, NSW); *ditto*, Oct 1990, *Henderson & Turpin* H3478 (BRI); *ditto*, Oct 1990, *Henderson & Turpin* H3479 (BRI); The Gap, along road to Larras Lee, c. 17 km NW of Molong, Nov 1987, *James* 912 (BRI, NSW); Bohena Creek to Boggabri, Aug 1911, *Jensen* (NSW); *ditto*, Aug 1911, *Jensen* (NSW); c. 9 km SW of Molong, Bocoble Gap, Oct 1992, *Makinson* 1199 (CANB, MEL, NSW); Bocoble Gap, c. 9 km (direct) SW of Molong, Oct 1992, *Makinson* 1198 (BRI, CANB, K, MEL, NSW); *ditto*, Oct 1992, *Makinson* 1197 (BRI, CANB, K, MEL, NSW); Kandos Weir, Aug 1990, *Ollerenshaw* 51 (BRI, CANB); Willala Gap, 55 km S of Narrabri, Dec 1973, *Streimann* HS744 (BRI); *ditto*, Dec 1973, *Streimann* HS741 (AD).

***Distribution and habitat*:** *Bertya oblonga* is confined to central New South Wales in scattered localities from Boggabri southwards to Molong and east to near Denman (Map 19). It is recorded from rocky sites on ridge tops or steep hillsides in open shrubland, eucalypt woodland or forest communities. Soils are recorded as shallow sands or loams overlying sandstone or shale.

***Phenology*:** Flowers have been recorded from July to October, fruits in October and December.

***Affinities*:** *Bertya oblonga* is similar to *B. glandulosa* from the south-east of Queensland. *B. oblonga* can be distinguished from that species by its glabrous adaxial leaf lamina surface, narrowly triangular calyx lobes in the female flower, and the stellate-pubescent abaxial surface of calyx lobes.

***Notes*:** This species as accepted here shows some variation in the width of the leaf laminas. In general, the western populations (e.g. *Jenson* [NSW194891]; *McKay* [NSW465750]) tend to have narrower leaves with a more revolute margin than those in the type material, and collections from near Cumnock (e.g. *Althofer* [NSW194913]; *Henderson & Turpin* H3480) have shorter and broader leaf laminas with the margins less recurved than those in the type material. Although not formally recognized here, this variation warrants further field research.

16. Bertya oleifolia Planch., London J. Bot. 4: 473, t. 16, fig. 1 (1845). **Type:** New South Wales. In arid country on the west of Wellington Valley, in 1825, *A. Cunningham* 49 (holo: K).

Bertya polymorpha Baill., Adansonia 6: 298/301 (1866), *nom. illeg*; *Bertya polymorpha* Baill. forma *polymorpha*, Baill. *loc. cit.*, *nom. illeg*. **Type:** New South Wales. In arid country on the west of Wellington Valley, in 1825, *A. Cunningham* 49 (lecto, here chosen: K).

Ricinocarpos mitchellii Sond., Linnaea 28: 563 (1857); *Bertya mitchellii* (Sond.) Müll.Arg., Linnaea 34: 63 (1865); *Bertya mitchellii* (Sond.) Müll.Arg.var. *mitchellii*, Grüning in A.Engler, Pflanzenr. H.58: 61 (1913). **Type:** [Queensland.] Nov. Holl. subtropica, [without date,] *Sir T. Mitchell* (lecto, here chosen: MEL (ex herb. Sonder) [MEL2062904]; isolecto: MEL [MEL114087, MEL2065936], K).

Bertya polymorpha forma *genuina*, Baill., Adansonia 6: 299 (1866), *nom. inval.*

Bertya mitchellii var. *genuina* Grüning in A.Engler, Pflanzenr. H.58: 61 (1913), *nom. inval.*

Monoecious or sometimes dioecious, much branched shrubs to 2.5 m high, viscid on flowers buds. Branchlets ± terete, with a dense indumentum of stellate hairs, becoming glabrous with age though remaining minutely tuberculate by persistent hair bases; hairs sessile or stipitate with stipes up to 0.3 mm long, white, 0.2–0.4 mm across. Leaves petiolate, spirally alternate, spreading; petiole plano-convex, 1.7–4 mm long, with a dense stellate-pubescent indumentum up to 0.2 mm thick; lamina linear-obovate to narrowly obovate or linear-elliptic to narrowly elliptic, 25–54 mm long, 2–8 mm wide; adaxial surface light green or grey-green, sparsely hairy with stipitate stellate hairs up to 0.2 mm across, glabrescent, minutely tuberculate with persistent hair bases; abaxial surface white, densely hairy with sessile and shortly stipitate hairs 0.2–0.5 mm across; margin recurved to revolute; apex acute, obtuse or rounded, rarely ultimately apiculate with extension from midrib up to 0.1 mm long terminated by a small gland; base obtuse to cuneate; midvein impressed adaxially, abaxially raised, angular, densely stellate-pubescent on all surfaces; marginal glands usually present at base of lamina, 1 each side of midrib, 0.1–0.2 mm across, mostly stipitate with stipes up to 0.2 mm long. Inflorescences of a single flower or sometimes umbelliform with 2 flowers, pedunculate, axillary; peduncles up to 1.5 mm long; bracts 7–12, persistent; outer bracts narrowly ovate to ovate, 2.2–5 mm long, 1.5–2.9 mm wide, obtuse to rounded or acute at tip, densely stellate-pubescent abaxially, glabrous or stellate-pubescent distally adaxially; inner bracts ovate to broadly ovate or orbicular, 2.0–4.2 mm long, 2.2–2.7 mm wide, obtuse to rounded at tip, glabrous or stellate-pubescent adaxially. Male flowers sessile or pedicellate with pedicels up to 1.5 mm long, glabrous except for scattered stellate hairs; calyx lobes 5, light green to yellowish coloured, ovate to ovate-elliptic or oblong-elliptic, 4.4–6.6 mm long, 2.5–3.8 mm wide, acute or rounded at tip, glabrous; androecium 4–6.7 mm long, 0.4–0.8 mm across; stamens 32–75; filaments c. 0.1 mm long; anthers 0.9–1.1 mm long. Female flowers sessile or shortly pedicellate with pedicels up to 0.5 mm long and glabrous; calyx 5-lobed, light green coloured; tube 0.3–0.6 mm long; lobes ± equal, erect, recurved distally, narrowly obovate to obovate, oblong-elliptic or elliptic-ovate, 3.3–5.2 mm long in flower, up to 8.3 mm long in fruit, 1.6–2.8 mm wide, acute to obtuse at tip, glabrous or sometimes with scattered stellate hairs abaxially, glabrous adaxially, with margins entire; petals rudimentary, up to 0.6 mm long, ovate or clavate, ± glabrous; ovary subglobose to ellipsoid, 1.5–2.0 mm long, 1.6–1.8 mm across, 3-locular, stellate-pubescent; style with hairy column 0.3–0.8 mm long and 3 spreading limbs; limbs red to maroon, 3.5–4.1 mm long, 0.4–0.7 mm wide, deeply 3– or 4-lobed; lobes 1.5–3.5 mm long, 0.2–0.3 mm wide. Capsule ellipsoid, 6.5–8.5 mm long, 3.8–4.8 mm across, with a sparse to moderately dense indumentum of stellate hairs, usually 1-seeded; persistent calyx lobes > half the capsule length. Seed obloid or obloid-ellipsoid, 4.9–6 mm long, 3.0–3.7 mm wide, 2.2–3.3 mm

across, dark brown and mottled with grey; caruncle pyramidal, 1.6–2.2 mm across, 1.2–1.4 mm long, yellowish-white.

***Selected specimens (from 107 examined)*: Queensland.** SOUTH KENNEDY DISTRICT: 81 km NNE of Jericho, Jul 1993, *Thompson & Figg* GAL171 (BRI). LEICHHARDT DISTRICT: near Get Down, Robinson Gorge, Expedition National Park, Sep 1995, *Forster & Figg* PIF17728 (BRI); 80 km E of Tambo on Springsure road, Sep 1974, *Gittins* 2779 (BRI, NSW); 38.1 km ENE of Taroom, Spring Creek Station, Sep 1996, *Halford & Dowling* Q3114 (AD, BRI, MEL); Carnarvon Gorge National Park, Salvador Rosa section, along track to Spyglass Peak, Aug 1990, *Henderson* H3398 (BRI); Salvator Rosa National Park, Major Mitchell Springs, Sep 1987, *Thomas* 210 (BRI). WARREGO DISTRICT: on 4WD road from Tambo to Springsure via Carwell Station, c. 70 km from Tambo, Oct 1987, *Henderson* H3097 (BRI). MARANOA DISTRICT: 10 miles [c. 16 km] SW of Yuleba on Surat road, Aug 1956, *Everist* 5814 (BRI, CANB). DARLING DOWNS DISTRICT: 26 miles [c. 42 km] E of Westmar, Aug 1961, *Pedley* 796 (BRI, CANB). MORETON DISTRICT: Bulls Falls Lookout, Mt Mee State Forest, W of Mt Mee, Jun 1998, *Bean* 13313 (BRI); E of 'Fair Hills', SW of Cooyar, Aug 1996, *Bean* 10596 (BRI, NSW); Cainbable Road, 16.8 km SSE of Beaudesert, Oct 1997, *Halford* Q3420 (BRI, MEL). **New South Wales.** MacIntyre Falls Fauna and Flora Reserve, c. 22 km NNW of Ashford, Oct 1990, *Coveny & Makinson* 14436 (BRI, CANB, MEL, NSW); 5 km SE of Mt Wambo, Sep 1974, *Coveny & Jacobs* 5597 (AD, BRI, CANB, MEL, NSW); Huntingdale, Capertee Valley, headwaters of Emu Swamp Creek, 4 km E of Genowlan Mountain, Jul 1995, *Crawford* 3067 (CANB); Shoalhaven River, c. 4 km downstream from Tallowa Dam, Nov 1988, *Davies & Richardson* 724 (BRI, CANB, MEL, NSW); c. 2 miles [3.6 km] E of Doyle's Creek (W of Jerry's Plains), Sep 1965, *Johnson* (NSW); "Darrowby", 3.5 km W of Broke along the Milbrodale Road, Hunter Valley, Aug 1985, *Palmer* 34 (CANB); Goulburn R. (Karrabee - Bylong) Hunter Valley, Apr 1983, *Tame* 958 (NSW); Darkey Creek, S of Milbrodale, Windsor/Singleton road, Sep 1972, *Williams* (BRI, CANB, NSW).

***Distribution and habitat*:** *Bertya oleifolia* is widespread in eastern Australia from Jericho, in central Queensland, southwards to Ashford, in northern New South Wales, and further south from Rylstone to Nowra, in southern New South Wales (Map 20). It grows in a variety of community types including tall open shrubland, woodland and open forest communities. Soils are recorded as mostly sandy often rocky and overlying sandstone substrates.

***Phenology*:** Flowers have been recorded from May to November, fruits from August to December.

***Notes*:** To fix the application of Baillon's illegitimate *Bertya polymorpha*, the holotype of *B. oleifolia* Planch., included by Baillon in his concept of *B. polymorpha*, is here selected as lectotype of Baillon's name.

The name *Bertya mitchellii* (Sond.) Müll.Arg. has been misapplied in the past (Bentham 1873, Weber 1986, James and Harden 1990, Jeanes 1999) to a taxon that is widespread in southern Australia here referred to as *B. tasmanica* subsp. *vestita.*

The misapplication appears to have been initiated by Jean Müller (1865) when he transferred *Ricinocarpos mitchellii* Sond. to *Bertya*. There, he cited Sonder's original name and place of publication as well as a specimen "Murray-River (F. Mueller in hb. Hook.)".

Sonder's *Ricinocarpos mitchellii* is based on a Major T. Mitchell collection from near Mantuan Downs in central Queensland and J. Müller's new name is therefore typified by the type of its basionym. An examination of Ferdinand Mueller's collection from the Murray River and the type of *Ricinocarpos mitchellii* Sond. revealed that they are not of the same taxon. Mueller's collection labelled 'Murray River' is referable to the taxon here named *B. tasmanica* subsp. *vestita*, while Mitchell's collection from Mantuan Downs is referable to the species *B. oleifolia* as circumscribed here.

17. Bertya opponens (F.Muell. ex Benth.) Guymer, Austrobaileya 2(2): 147 (1985); *Croton opponens* F.Muell. ex Benth., Fl. Austral. 6: 125/6 (1873). **Type:** Queensland. [without date and name of collector] (holo: MEL [MEL604903]).

Bertya oppositifolia F.Muell. & O'Shanesy, S. Sci. Rec. 2(5): 98 (1882). **Type:** [Queensland.] on sandy ridge west of Nogoa-River, in 1879, *P.A. O'Shanesy* (lecto: MEL [MEL104213], *fide* G.P. Guymer, Austrobaileya 2(2): 147 (1985)).

Bertya species A, James & Harden (1990, p. 418).

***Illustration*:** G.M. Cunningham *et al.* (1982, p. 453).

Monoecious or dioecious, much branched shrubs or small trees up to 5 m high, viscid on flower buds. Branchlets ± terete, with a dense indumentum of stellate hairs, somewhat floccose, becoming glabrous with age; hairs sessile or stipitate with stipes up to 0.8 mm long, mostly white or sometimes pale rusty-brown, 0.2–0.8 mm across. Leaves petiolate, opposite or sometimes subopposite, spreading; petiole plano-convex, 4–9 mm long, with a dense stellate-pubescent indumentum up to 0.2 mm thick; lamina narrowly elliptic to elliptic, oblong-elliptic, narrowly oblong or narrowly oblong-obovate, (25–)35–72 mm long, 6–22 mm wide; adaxial surface green to dark green, with a sparse to moderately dense indumentum of sessile or shortly stipitate stellate hairs 0.2–0.4 mm across, glabrescent, smooth or minutely tuberculate with persistent leaf bases; abaxial surface mostly white or sometimes pale rusty brown along midrib, densely hairy with sessile and stipitate stellate hairs 0.4–1.0 mm across; margin slightly to distinctly recurved; apex rounded or obtuse; base obtuse or slightly attenuate; midvein impressed adaxially, abaxially raised and ± rounded, densely stellate-pubescent; marginal glands present at base of lamina, 1 each side of midrib, 0.1–0.2 mm across, sessile or stipitate with stipes 0.2–0.5 mm long. Inflorescences of a single flower or umbelliform with 2 or 3 flowers, pedunculate, axillary; peduncles up to 2 mm long; bracts 4–7, persistent, oblong or ovate to broadly ovate, 2–4.4 mm long, 1.9–3 mm wide, rounded to obtuse or acute at tip, densely stellate-pubescent to glabrous abaxially, mostly glabrous adaxially. Male flowers sessile; calyx lobes 4 (sometimes 5), of unknown colour when fresh, elliptic, 7–9.5 mm long, 4–6.5 mm wide, rounded at tip, glabrous; androecium 6.0–13.0 mm long, 1.5–1.7 mm across; stamens 77–114; filaments 0.1–0.5 mm long; anthers 1.3–1.8 mm long. Female flowers sessile or rarely pedicellate with pedicels up to 2 mm long and glabrous; calyx 4(rarely 5)-lobed, light green coloured; tube 0.4–1 mm long; lobes equal or unequal, erect, recurved distally, ovate to broadly ovate, 5–5.7 mm long, 3.4–5.2 mm wide, obtuse to rounded at tip, glabrous, with margins entire; petals rudimentary, up to 1.6 mm long and 0.7 mm wide, ovate, glabrous; ovary subglobose, 1.8–2.8 mm long, 1.8–2.1 mm across, 3-locular, densely stellate-villose; style with hairy column 0.4–1.0 mm long and 3 spreading limbs; limbs yellow-green to red, 5–8 mm long, 1–2 mm wide, deeply 4– to 6(rarely 8)-lobed; lobes 1.8–5.5 mm long, 0.3–0.7 mm wide. Capsule ovoid to subglobose, 9–14 mm long, 9–13 mm across, densely stellate-villose, usually 3-seeded; persistent calyx lobes ≤ half the capsule length. Seed obloid, 7.5–8.9 mm long, 3.8–4.0 mm wide, 2.8–3.1 mm across, light to dark brown; caruncle pyramidal, c. 2.6 mm across, c. 1.8 mm long, yellowish-white.

***Selected specimens (from 48 examined)*: Queensland.** Burke District: Bertya Creek, W of 'Warang', White Mountains National Park, Jun 1992, *Bean* 4614 (BRI, NSW). Leichhardt District: Fairbairn Dam, Emerald, Jul 1981, *Williams* 81013 (BRI). Port Curtis District: Kroombit Creek, Kroombit Tops, Oct 1995, *Brushe & Brushe* JB242 (BRI); Mt Castletower, Many Peaks Range, Jun 1977, *Telford* 5481 (BRI, CANB, NSW); 15 km NE of Biloela, 3 km N of Callide Dam, Jul 1992, *Thompson* BIL18 (BRI, CANB, NSW). Burnett District: 300 m S of Scrubby Dam, Coominglah State Forest, Sep 1995, *Bean & Robins* 8895 (BRI, NSW); State Forest 172, near Meredith's Road, Gurgeena Plateau, Nov 1994, *Forster* PIF15909 (BRI). Warrego District: Mount Mobil Holding, 15-20 km W of Umberill Homestead, Nov 1990, *Grimshaw* CHR17 (BRI); c. 36 km NNE of Morven, along dogfence, Aug 1990, *Henderson et al.* H3392 (BRI). Maranoa District: Thomby Range, SE of Surat, May 1960, *Blake* 21306 (BRI, NSW); Thomby Range, c. 43 km SE of Surat, on "Glen Fosslyn" Station, Aug 1990, *Henderson & Franks* H3377 (BRI). Darling Downs District: State Forest 101, c. 7 km due N of Coolmunda Dam, Jun 1994, *Grimshaw & Taylor* PG823 (BRI, NSW). Moreton District: East of Egypt, 25 km E of Gatton, Oct 1991, *Bird* (BRI, NSW); Falls Creek, 4 km NW of West Haldon, Nov 1988, *Forster* PIF4761 & *Bird* (BRI); Crest of mountain spur to S of crossing of Heifer Creek on Gatton to Clifton Road, Aug 1990, *Henderson et al.* H3374 (BRI). **New South Wales.** "Devils Face", c. 2 km E of Jessie Smith trig., Kangaroo River State Forest, Jan 1999, *Austin* (BRI); 5 km SW of Turrawan, 20 km SE of Narrabri, *Briggs* 4694 (NSW); "Elmore", Coolabah, Feb 1973, *Cunningham* 594 (NSW); "Windera", Cobar, Jul 1969, *Cunningham* (NSW); Ridge above Barool Creek, Gibraltar Range State Forest, Aug 1991, *Binns* 1774 (NSW).

***Distribution and habitat*:** *Bertya opponens* is widely scattered in eastern Australia from near Charters Towers, in north-east Queensland, southwards to Cobar and Coffs Harbour, New South Wales (Map 21). It is recorded growing in a variety of community types including mixed shrubland, lancewood woodland, mallee, eucalypt/*Acacia* open forest with shrubby understorey, eucalypt/*Callitris* open woodland and semi-evergreen vine-thicket. The soils are recorded as generally shallow

sandy loams or red earths associated mostly with sandstone, but also with rhyolite, shale or metasediments.

***Phenology*:** Flowers have been recorded from June to November, January and March, fruits between August and November.

***Notes*:** *Bertya opponens* is characterized by having a dense stellate-pubescent indumentum on young branchlets and leaves, calyx lobes in female flowers ovate to broadly ovate, ovary densely hairy, capsule mostly 3-seeded and leaves consistently opposite.

As circumscribed here, *B. opponens* has considerable variation in its habit, indumentum colour and leaf shape. In general the northern populations (from Emerald to near Toowoomba, Queensland) tend to have broader, oblong to oblong-elliptic leaf laminas with usually flat margins while the southern populations from Morven and Surat, Queensland and those throughout New South Wales have narrower, linear-elliptic to narrowly elliptic leaf laminas with revolute margins. However, these variations tend to intergrade and are not considered worthy of formal recognition.

The indumentum of this species is mostly white, but there are a number of collections (e.g. from between Grafton and Coffs Harbour, *Austin* (BRI), and from near Toowoomba, *Forster* PIF4761 & *Bird* (BRI) and *Henderson* H3375 (BRI)) that have a rusty-brown indumentum on most parts but particularly on young branchlets. Whether or not these forms are worthy of formal recognition warrants further study.

18. Bertya pedicellata F.Muell., Fragm. 4: 143/144 (1864). **Type:** [Queensland.] Rockhampton, [without date,] [*A.*] *Thozet* (lecto, here chosen: MEL [MEL114092]).

Bertya glabrescens (C.T.White) Guymer, Austrobaileya 2(5): 429 (1988*); Bertya oleifolia* var. *glabrescens* C.T.White, Proc. Roy. Soc. Queensland 50: 86 (1939). **Type:** [Queensland. BURNETT DISTRICT:] Eidsvold, [without date,] *T.L. Bancroft* (holo: BRI [AQ342448, sheet 1]; iso: BRI [AQ342448, sheet 2], ?K *n.v.*, *fide* G.P. Guymer, Austrobaileya 2(5): 429 (1988)).

Monoecious, much branched shrubs up to 6 m high, thinly viscid on young shoots, leaves and flowers. Branchlets ± terete, with a moderately dense indumentum of stellate hairs, becoming glabrous with age, rugose; hairs ± sessile, white, 0.2–0.3 mm across. Leaves petiolate, spirally alternate or opposite, spreading; petiole ± plano-convex, 1.5–5.2 mm long, with a sparse stellate-pubescent indumentum up to 0.1 mm thick; lamina linear-elliptic, linear-obovate or sometimes linear, 40–92 mm long, 1.6 3–10 mm wide; adaxial surface green, sparsely hairy with stellate hairs up to 0.3 mm across, glabrescent, smooth; abaxial surface white, densely hairy with ± sessile stellate hairs 0.2–0.6 mm across; margin recurved or sometimes revolute at least in dried state; apex acute or obtuse, ultimately apiculate with an extension from midrib up to 0.2 mm long terminated with small gland; base attenuate; midvein impressed adaxially, abaxially raised and angular, with stellate hairs on abaxial face, becoming glabrous, stellate-pubescent laterally; marginal glands present at base of lamina, 1 each side of mibrib, c. 0.1 mm across, sessile or stipitate with stipes up to 0.1 mm long. Inflorescences of a single flower or umbelliform with 2 flowers, subsessile or pedunculate, axillary; peduncles up to 6 mm long; bracts 6–9, ± persistent but falling off before the fruit matures, narrowly ovate to ovate or oblong, 2.4–3.7 mm long, 0.5–2.1 mm wide, acute to obtuse at tip, stellate-pubescent to glabrous abaxially, glabrous adaxially. Male flowers sessile; calyx lobes 5(rarely 4 or 6), yellow-green coloured, elliptic or ovate-elliptic, 4.5–5.5 mm long, 3–4.2 mm wide, rounded at tip, glabrous; rudimentary petals sometimes present when up to 2 mm long; androecium 5–8 mm long, 0.7–1.3 mm across; stamens 56–70; filaments c. 0.1 mm long; anthers 0.8–1.1 mm long. Female flowers pedicellate; pedicels 1.5–3 mm long in flower, to 4 mm long in fruit, glabrous; calyx 4(rarely 5)-lobed, light green coloured; tube 0.2–0.4 mm long; lobes equal, erect, recurved distally, narrowly ovate or oblong-ovate, 3.2–5.2 mm long in flower, up to 7.5 mm long in fruit, 0.9–1.7 mm wide, acute to rounded at tip, glabrous, with margins entire; petals rudimentary, up to 2 mm long and 0.9

mm wide, ovate, glabrous; ovary ovoid or ellipsoid, 1.5–3.1 mm long, 1.1–2.2 mm across, 3(rarely 4)-locular, usually with scattered stellate hairs; style with ± glabrous column 0.3–0.4 mm long and 3(rarely 4) ascending limbs; limbs red to maroon or pale yellow, 3.3–4.1 mm long, 0.5–0.8 mm wide, deeply 3– to 5-lobed; lobes 1.3–2.2 mm long, 0.2–0.4 mm wide. Capsule narrowly ellipsoid or narrowly ovoid, 8.5–11.3 mm long, 4.7–5.2 mm across, glabrous or with scattered stellate hairs, usually 1-seeded; persistent calyx lobes > half the capsule length. Seed obloid or obloid-ellipsoid, 5.1–5.8 mm long, 3.2–3.6 mm wide, 2.8–3.1 mm across, light brown and mottled with dark brown and black; caruncle pyramidal, 2.0–2.1 mm across, 1.3–1.7 mm long, creamy-white.

***Selected specimens (from 38 examined)*: Queensland.** LEICHHARDT DISTRICT: just below the summit of Ropers Peak, NE of Capella, Aug 1987, *Bean* 631 (BRI); Ropers Peak, Peak Range, Aug 1990, *Forster* PIF7207 (BRI); 25.1 km ENE of Taroom, Beaumont Station, Nov 1996, *Halford & Dowling* Q3221 (BRI, NSW); on Nebo-Clermont road, 80 km from Nebo, May 1962, *Johnson* 2368 (AD, BRI, CANB, NSW); Grey Rock, Glenlea Road, WNW of Springsure, Jul 1989, *O'Keeffe* 889 (BRI). PORT CURTIS DISTRICT: Mt Hedlow, 16 km W of Yeppoon, Jun 1983, *Anderson* 3442 (BRI); Prospect Peak, c. 35 km S of Biloela, Jun 1996, *Bean* 10439 (BRI, MEL, NSW); Prospect Peak, c. 35 km S of Biloela, Jun 1996, *Bean* 10438 (BRI, MEL, NSW); Mt Jim Crow, Aug 1980, *Hind & Ingram* 2663 (NSW); Ironpot/Bluff Rock Island off Kemp Beach, Sep 1996, *Melzer* RM750 (BRI); Rosslyn Head, Jul 1997, *Rider* (BRI). BURNETT DISTRICT: Mt Gayndah, 7 km W of Gayndah, Sep 1999, *Forster et al.* PIF24864 (BRI); 4.5 km S of Binjour, Sep 1989, *Forster & Bean* PIF5743 (BRI); Coongara Rock, May 1996, *Grimshaw & Baumgartner* PG2395 (BRI, MEL); northern boundary of SF 132, 35 km SSW of Mundubbera, Jul 1997, *Halford & Holland* Q3295 (BISH, BRI, MEL); 4 km W along Humphrey Road from Burnett Highway, Aug 1990, *Henderson & Franks* H3400 (BRI); 4.5 km S of Binjour, on road to Humphrey, Oct 1989, *Ross* 8914 (BRI, NSW). DARLING DOWNS DISTRICT: Lot 1656 Parish of Rosenthah, Shire of Warwick, May 1995, *Sands* 3 (BRI).

***Distribution and habitat*:** *Bertya pedicellata* is confined to central and south-east Queensland, from near Aramac eastwards to Rockhampton and south to near Biggenden with an isolated record from the Warwick district (Map 22). It is recorded as growing on rocky hillsides in eucalypt forest or woodland, *Acacia* woodland or shrubland, and open heathland or vine thicket communities. Soils are recorded mostly as skeletal to shallow sandy, sandy clay or clay loams overlying rhyolite, trachyte or sandstone substrates.

***Phenology*:** Flowers have been recorded from March to November, fruits from August to November.

***Typification*:** In the protologue of *Bertya pedicellata*, Mueller (1864) cited "in thickets near the town of Rockhampton, Thozet". Four collections at MEL and one amongst material on loan to BRI from K have been located that are labelled *B. pedicellata* and have Thozet as the collector with the locality of collection as Rockhampton. Three of the MEL sheets are without a date of collection while the fourth is dated 1865. As this date is after Mueller's publication of the name *B. pedicellata*, this sheet has been excluded from consideration as type material. Although the K sheet is dated 1872, we believe this is the date when it was sent to K. The K sheet and the remaining three sheets at MEL are here assumed to be original material available to Mueller prior to his publication of *B. pedicellata*. From these, the MEL sheet MEL114092 is chosen here as lectotype because it agrees with the protologue and is the most ample of the three MEL type sheets, as well as the K one.

***Notes*:** *Bertya pedicellata* is characterized by the more or less sessile stellate hairs on the branchlets, the opposite as well as alternate arrangement of its leaves, the mostly linear-elliptic or linear-obovate leaf laminas which are glabrescent and smooth on the adaxial surface, and its long-pedicellate female flowers.

The leaf laminas can vary in width seemingly depending on the moisture available to the plant at any particular site. Plants on dry skeletal soils tend to have a large proportion of narrow leaf laminas with margins recurved or revolute to some extent and sometimes even to the midrib, whereas plants on sloping sites and sandy loam soil tend to have leaf laminas flatter and slightly broader.

A collection from near Warwick, Queensland, *Sands* 3 (BRI), is from a population disjunct from others of *B. pedicellata* and it has extremely narrow leaf laminas. This population warrants further study to establish the significance of these differences.

The O'Keeffe collection from WNW of Springsure, *O'Keeffe* 889 (BRI), has male flowers with what we interpret to be rudimentary petals near the base of the staminal column. This is the only *Bertya* specimen that has been observed to have rudimentary petals in male flowers.

19. Bertya pinifolia Planch., London J. Bot. 4: 473 (1845). **Type:** [Queensland. MORETON DISTRICT:] Brisbane River [Minto Crags], in 1829, *Fraser* 158 (lecto, here chosen: K).

Monoecious, much branched shrubs up to 2 m high, viscid throughout. Branchlets somewhat angular, becoming terete with age, glabrous, tuberculate. Leaves petiolate, spirally alternate, ascending to spreading; petiole plano-convex, 0.7–1.6 mm long, glabrous, sparsely tuberculate; lamina linear, 25–60 mm long, 0.8–1.5(–2.1) mm wide, slightly recurved at tip; adaxial surface green, glabrous, tuberculate; abaxial surface white, densely hairy with sessile and stipitate stellate (0.4–0.5 mm across) and simple glandular (up to 0.05 mm long) hairs; margin revolute or recurved to midrib concealing abaxial leaf lamina surface; apex acute, ultimately apiculate with an extension from the midrib up to 0.2 mm long terminated with a small, light brown gland; base cuneate; midvein impressed adaxially, abaxially raised and angular, tuberculate and glabrous on abaxial face, stellate-pubescent laterally; marginal glands usually present at base of lamina, 1 each side of midrib, 0.15–0.2 mm across, sessile. Inflorescences of a single flower, pedunculate, axillary; peduncles up to 1.5 mm long; bracts 5–7, persistent, narrowly ovate to ovate, 1.7–3.5 mm long, 0.6–1.5 mm wide, acute or obtuse at tip, glabrous. Male flowers shortly pedicellate; pedicels up to 0.8 mm long, glabrous; calyx lobes 5, yellow-green, ovate-elliptic to elliptic, 3–4.8 mm long, 1.7–2.6 mm wide, rounded at tip, glabrous; androecium 3.5–6.2 mm long; 0.4–0.6 mm across; stamens 30–45; filaments c. 0.1 mm long; anthers 0.8–1.4 mm long. Female flowers subsessile; calyx 5-lobed, yellow-green coloured; tube up to 0.2 mm long; lobes equal, erect, elliptic to oblong-elliptic, 2.9–3.6 mm long in flowers, up to 9 mm long in fruit, 1.3–1.9 mm wide, rounded at tip, glabrous, with margins fimbriate; petals rudimentary, up to 0.3 mm long and 0.2 mm wide, ovate, glabrous; ovary ovoid, 1.1–1.3 mm long, 1.0–1.2 mm across, 3-locular, glabrous; style with glabrous column 0.5–1 mm long and 3 spreading limbs; limbs red, 3.0–4.2 mm long, 0.4–0.6 mm wide, deeply 3– or 4-lobed; lobes 1.3–2.9 mm long, 0.2–0.3 mm wide. Capsule narrowly ellipsoid, 7–7.5 mm long, 3.2–3.5 mm across, glabrous, usually 1-seeded; persistent calyx lobes longer than the capsule. Seed obloid, 4.7–5.2 mm long, 2.7–2.8 mm wide, 2.3–2.4 mm across, dark red; caruncle pyramidal, 1.2–1.4 mm across, 0.7–0.8 mm long, creamy-white.

***Selected specimens (from 10 examined)*: Queensland.** MORETON DISTRICT: Black Rock Creek Road, 12 km S of Boonah, Aug 1990, *Bird* & *Orford* A (BRI, NSW); *ditto*, Aug 1990, *Bird* & *Orford* B (BRI, NSW); *ditto*, Aug 1990, *Bird* & *Orford* C (BRI, NSW); *ditto*, Jul 1988, *Bird* (BRI, CANB, NSW); 2 km SSE of Mt Bangalora, Sep 1987, *Forster et al.* PIF3036 (BRI, NSW); Flagstone Creek, Boonah District, Sep 1934, *Michael* 2050 (BRI); E of Moogerah Dam on Boonah Road, Dec 1998, *Olsen* (BRI).

***Distribution and habitat*:** *Bertya pinifolia* is confined to the south-east of Queensland, where it is restricted to rocky sites in the Boonah district (Map 23). It is recorded as growing in open heath or shrubland communities on rocky ridges or mountain summits on skeletal soils overlying rhyolite.

***Phenology*:** Flowers have been recorded from July to September, fruits in September.

***Affinities*:** *Bertya pinifolia* seems most closely related to *B. gummifera*, *B. granitica* and *B. recurvata* but differs from all three species in having proportionally longer leaves (leaf lamina length/width ratio greater than 30:1 compared with less than 25:1). For further differences between *B. pinifolia* and each of these three species, refer to the 'affinities' section under the species concerned.

***Typification*:** Two sheets of original material of *B. pinifolia* were located amongst material on loan to BRI from K. Both sheets have been stamped as originating from Hooker's herbarium. Each has what appears to be a field label written by the same hand stating "Brisbane River, [illegible], Fraser 1829, 158" and "Croton rosmarinifolia, [illegible], Fraser 1829, 155" respectively. Both specimens agree with the protologue of *B. pinifolia*. The

specimen labelled 158 is chosen here as the lectotype as it is annotated with the name *B. pinifolia* in what we believe to be Planchon's hand.

20. Bertya polystigma Grüning in A.Engler, Pflanzenr. H.58: 57-59 (1913). **Type:** "N. Queensland. Walshs Pyramid. in stone ground between low shrub (*L. Diels* n. 8341)" (holo: B, apparently destroyed; lecto, here chosen: G. Grüning in A. Engler, Pflanzenr. H.58: 58, fig. 11 (1913); epitype, here chosen: Queensland. Cook District: Massey Creek Falls, S of Gordonvale, 18 February 1996, *R.L. Jago & R. Jensen* 3788 (BRI)).

Illustration: G. Grüning (1913: p. 58, fig. 11).

Monoecious, much branched shrubs up to 3(6) m high. Branchlets ± terete, with a dense indumentum of stellate hairs, becoming glabrous with age; hairs sessile or stipitate with stipes up to 0.4 mm long, white, 0.4–0.7 mm across. Leaves petiolate, spirally alternate, spreading; petiole plano-convex, 1.2–4.5 mm long, with a dense stellate-pubescent indumentum up to 0.7 mm thick; lamina lorate to narrowly oblong or narrowly oblong-elliptic, 18–54 mm long, 2.4–5.3(–8.6) mm wide; adaxial surface green, sparsely hairy with sessile or stipitate stellate hairs 0.3–0.6 mm across, glabrescent, smooth or minutely tuberculate with persistent hair bases; abaxial surface white, densely hairy with sessile or shortly stipitate stellate hairs 0.4–0.5 mm across; margin recurved to revolute; apex acute, rounded to obtuse, sometimes ultimately apiculate with an extension from midrib up to 0.1 mm long and terminated with a small, light brown coloured gland; base cuneate; midvein impressed adaxially, abaxially raised and angular, stellate-pubescent; marginal glands present at base of lamina, 1 each side of midrib, 0.1–0.15 mm across, stipitate with stipes up to 0.1 mm long. Inflorescences of a single flower or rarely umbelliform with 2 flowers, pedunculate, axillary or rarely terminal on much reduced axillary branchlets; peduncles 1–4 mm long; bracts 4–6, persistent; outer bracts lorate or ovate, 2.5–3.5 mm long, 0.9–1.4 mm wide, rounded at tip, stellate-pubescent on both surfaces; inner bracts ovate to broadly ovate or orbicular, 0.9–2.2 mm long, 0.9–1.4 mm wide, acute to obtuse at tip, glabrous or with scattered stellate hairs distally abaxially. Male flowers pedicellate; pedicels 0.5–1 mm long, stellate-pubescent; calyx lobes 5, light green coloured, oblong-elliptic, 4.5–5.1 mm long, 2.5–2.9 mm wide, rounded at tip, glabrous; androecium 5–8 mm long, 0.5–0.8 mm across; stamens 57–73; filaments 0.1–0.2 mm long; anthers 1–1.3 mm long. Female flowers sessile or shortly pedicellate with pedicels up to 0.4 mm long, glabrous; calyx 5-lobed, light green coloured; tube 0.3–0.4 mm long; lobes equal, erect to spreading, recurved distally, narrowly ovate to ovate, 1.9–3.1 mm long, 1.0–1.6 mm wide, obtuse at tip, glabrous, with margins fimbriate; petals rudimentary, ovate, up to 0.4 mm long and 0.1 mm wide, glabrous; ovary ovoid, 1.0–1.3 mm long, 0.9–1.0 mm across, 3-locular, stellate-tomentose; style with hairy column c. 0.3 mm long and 3 spreading limbs; limbs pale yellow or red, 2.4–3.5 mm long, 0.6–0.7 mm wide, deeply 3- or 4-lobed; lobes 1.3–3.0 mm long, 0.1–0.2 mm wide. Capsule ellipsoid, 5.9–7.1 mm long, 3.5–3.8 mm across, usually with scattered stellate hairs, usually 1-seeded; persistent calyx lobes ≤ half the capsule length. Seed obloid, 5.0–5.2 mm long, 2.7–2.8 mm wide, 2.2–2.4 mm across, light brown to reddish brown; caruncle pyramidal, 1.2–1.8 mm across, 0.8–1 mm long, creamy-white.

***Selected specimens (from 29 examined)*: Queensland.** Cook District: Carrington Falls, SSW of Atherton, Jan 1993, *Bean* 5708 (BRI); Emu Creek, c. 10 miles [16 km] SW of Mareeba, Apr 1967, *Brass* 33533 (BRI, K); Atherton district, R 99W, Dec 1958, *Dansie & Volck* 1491 (BRI, CANB); Bakers Blue Mountain, Font Hills Station, Mona Creek Saddle, Dec 1988, *Fell* DF1564 (BRI); Daintree National Park, Little Daintree River, May 1998, *Forster et al.* PIF22825 (BRI); State Forest 144, Mt Windsor Tableland, Jul 1995, *Forster & Figg* PIF17427 (BRI); State Forest 185, Danbulla, 6 km along C road, Jan 1993, *Forster & Bean* PIF13077 (BRI); State Forest 607, Dinden, Bridle Logging Area, Jul 1995, *Forster et al.* PIF17351 (BRI); 5 km W of Rifle Range, Atherton, May 1976, *Hassall* 7623 (BRI); Carrington Falls, c. 8 km SSW of Atherton, Apr 1989, *Henderson & Clarkson* H3224 (BRI); near dam wall of Wild River Reservoir, c. 12 km SSW of Atherton, Apr 1989, *Henderson & Clarkson* H3219 (BRI); S.F.R. 194, Oct 1973, *Hyland* 6910 (BRI, CANB, K, NSW); Reserve 99, between Atherton and Herberton, Jun 1961, *Hyland* 1872 (BRI); Carrington Falls, Feb 1975, *Hyland* 8075 (BRI, CANB, K, NSW); Massey Creek Falls, S of Gordonvale, Feb 1996, *Jago*

& *Jensen* 3788 (BRI); between Barron and Walsh Rivers, c. 6 miles [10 km] W of Atherton, Apr 1959, *Thorne & Dansie* 20741 (BRI); Davies Creek area, Jan 1962, *Webb & Tracey* 5653 (BRI). NORTH KENNEDY DISTRICT: Herberton, Jan 1912, *Kenny* (BRI); 4.5 km N of Ravenshoe, Jul 1978, *Lockyer* 158 (BRI).

***Distribution and habitat*:** *Bertya polystigma* is confined to the north-east of Queensland, from Mt Windsor Tableland southwards to Ravenshoe (Map 24). It is recorded as growing on coarse sandy soils in rocky granitic habitats in a variety of vegetation types including eucalypt woodland and open or closed forest and less frequently in open *Syncarpia* forest or rainforest.

***Phenology*:** Flowers have been recorded in October to July, fruits in January, May, July, September and October.

***Affinities*:** *Bertya polystigma* seems most closely allied to *B. ingramii* and *B. oleifolia*. It differs from *B. ingramii* in having a smooth adaxial leaf lamina surface, longer indumentum on stems and abaxial leaf lamina surfaces, and the midrib impressed on the upper leaf lamina surface. *B. polystigma* differs from *B. oleifolia* in its calyx lobes which do not enlarge as the fruit matures.

***Typification*:** It seems reasonable to assume that the collection referred to by Grüning in his protologue of *B. polystigma* (*Diels* n.8341) was at B where Diels' herbarium was located. No type material has been located at B and it is believed to have been destroyed during the Second World War. Searches for duplicates at other herbaria (BM, MEL and CANB) where duplicates may exist according to Stafleu and Cowan (1976) have been unsuccessful. As there appears to be no extant holotype or isotype material available, the illustration in the protologue is here selected as lectotype, in accordance with article 9.10 of the International Code of Botanical Nomenclature (ICBN) (Greuter *et al.* 2000). Grüning's description and illustration are clearly diagnostic and leave no doubt as to the application of the name. However, to enable the precise taxonomic interpretation of this type, we also designate an epitype (Art. 9.7).

21. Bertya pomaderroides F. Muell., Fragm. 4: 34/35 (1863); *Bertya pomaderroides* F.Muell. var. *pomaderroides*, Blakely, Contr. New South Wales Natl Herb. 1: 121 (1941). **Type:** [New South Wales.] Bent's Basin, [without date,] *W. Woolls* (lecto, here chosen: MEL [MEL114101]; isolecto: K, MEL [MEL114102, MEL114100, MEL114099], NSW [NSW194854]).

Bertya oblongifolia Müll.Arg., Flora 47(30): 471 (1864). Type: [Australia, without locality, without date,] *C. Stuart* (holo: K (ex herb. Hook.)).

Bertya pomaderroides var. *angustifolia* Blakely, Contr. New South Wales Natl Herb. 1: 121 (1941). Type: New South Wales. Woronora River, 15 Sep 1923, *E. Cheel* [NSW194873] (holo: NSW).

Illustration: G. Grüning (1913: p. 55, fig. 10A) as *Bertya oblongifolia*.

Monoecious, much branched shrubs up to 2 m high, sometimes viscid on very young buds. Branchlets ± terete, with a moderately dense indumentum of stellate hairs, becoming glabrous with age though remaining tuberculate by persistent hair bases; hairs sessile or stipitate with stipes up to 0.3 mm long, pale golden-yellow to white, 0.2–0.5 mm across. Leaves petiolate, spirally alternate, spreading; petiole plano-convex, 1.5–4.8 mm long, slightly grooved adaxially, with a moderately dense stellate-pubescent indumentum up to 0.1 mm thick; lamina narrowly elliptic, oblong-elliptic to narrowly oblong-elliptic or rarely narrowly obovate, 16–46 mm long, 4–13 mm wide; adaxial surface green, glabrous, smooth; abaxial surface white, densely hairy with sessile stellate hairs 0.3–0.4 mm across; margin flat, recurved or sometimes revolute; apex rounded to obtuse rarely or acute; base obtuse to cuneate; midvein impressed adaxially, abaxially raised and angular or rounded, stellate-pubescent; marginal glands present at base of lamina, 1 each side of midrib, 0.1–0.2 mm across, sessile. Inflorescences of a single, flower, pedunculate, axillary; peduncles 8–16 mm long; bracts 3–5, persistent to somewhat caducous, narrowly ovate, narrowly triangular or lorate, 1.5–3.5 mm long, 0.6–1.3 mm wide, acute or obtuse at tip, glabrous or stellate-pubescent abaxially.

Male flowers sessile or pedicellate with pedicels up to 2 mm long, glabrous; calyx lobes 5, light green, elliptic or ovate, 3.1–3.8 mm long, 1.7–2.6 mm wide, rounded or obtuse at tip, glabrous; androecium 6.0–6.7 mm long, 0.6–0.8 mm across; stamens 56–75; filaments 0.1–0.2 mm long; anthers 1.1–1.3 mm long. Female flowers sessile or pedicellate with pedicels 0.2–1.5 mm long, glabrous or stellate-pubescent; calyx 5-lobed, light green coloured; tube 0.2–0.4 mm long; lobes equal, erect, narrowly triangular, 2.1–2.7 mm long, 0.6–0.8 mm wide, acute at tip, glabrous, with margins entire; petals absent; ovary narrowly ovoid or ellipsoid, 1.5–2.5 mm long, 1.0–1.3 mm across, 3-locular, glabrous or with scattered stellate hairs distally; style with hairy column c. 0.1 mm long and 3 spreading limbs; limbs red, 2.3–2.8 mm long, 0.2–0.4 mm wide, deeply 3– to 5-lobed; lobes 0.9–2.2 mm long, 0.1–0.2 mm wide. Capsule narrowly ovoid, 6.5–9.8 mm long, 3–4.1 mm across, glabrous or with scattered stellate hairs, usually 1-seeded; persistent calyx lobes ≤ half the capsule length. Seed obloid or obloid-ellipsoid, 5.5–6.2 mm long, 2.7–3.2 mm wide, 2.4–2.9 mm across, dark red; caruncle pyramidal, c 1.5 mm across, c. 1.5 mm long, yellowish-white.

***Selected specimens (from 41 examined)*: New South Wales.** Kangaroo River in National Park, Sep 1893, *Betche* (NSW); Nepean River catchment, near Menangle, Apr 1962, *Burgess* (CANB); Bargo River, Apr 1962, *Burgess* (CANB); Hilltop, Jul 1914, *Cheel* (BRI, NSW); Georges River, Sep 1896, *Clarke* (NSW); Woronora River, Sep 1896, *Clarke* (NSW); St Helena, 4 miles [c. 6 km] S of Springwood, Nov 1960, *Constable* (NSW); Glenbrook Creek, Chambers Gorge, 1 mile [c. 1.6 km] SE of Glenbrook, Oct 1965, *Coveny* (NSW); Kangaroo Creek, Royal National Park, Sep 1966, *Coveny* (NSW); Scouter's Mountain track crossing at Heathcote Creek, Heathcote National Park, Sep 1983, *Coveny & Bishop* 11617 (NSW); Glenbrook Creek, Glenbrook, Blue Mountains National Park, Feb 1998, *Coveny & Jobson* 17616 (CANB, NSW); The Woolwash, Campbelltown, Sep 1983, *Coveny & Bishop* 11619 (NSW); Georges River, Oct 1894, *Fletcher* (NSW); Morton National Park, Northern Budawang Range, c. 3 km NW of "The Castle", Oct 1985, *Gilmour* 5282 (CANB); Cataract Dam, Sep 1908, *Maiden* (NSW); Luncheon Creek, Jerrawangala State Forest, Sep 1985, *Mills* (NSW); ridge SW of Gadara Point, Northern Budawang Range, Feb 1974, *Olsen* 1875 (NSW); c. ½ way down Nepean Gorge from Glenbrook, Sep 1961, *Pearce* (NSW); Northern Budawang Range, gorge below Crooked Falls, Jan 1986, *Telford* 10177 (CANB, MEL, NSW); Little River, Buxton, Sep 1951, *Whaite* 1081 (NSW).

***Distribution and habitat*:** *Bertya pomaderroides* is confined to the south-east of New South Wales, from Glenbrook southwards to Budawang Range (Map 25). It is recorded as growing in open eucalypt forest usually along creek or river banks rarely on steep hillsides or exposed rock outcrops. Soils are recorded as sandy associated with sandstone or rhyolite substrates.

***Phenology*:** Flowers have been recorded throughout the year, particularly in September and October, fruits in February, April, July and from September to November.

***Affinities*:** *Bertya pomaderroides* seems most closely related to *B. brownii* but differs from that by having a glabrous adaxial leaf lamina surface, generally smaller and thicker leaves, a finer indumentum on the branchlets and abaxial leaf lamina surface, the presence of a single size class of hair in the abaxial leaf lamina surface, and a glabrous or sparsely stellate-pubescent ovary.

***Typification*:** In the protologue of *Bertya pomaderroides*, Mueller (1863) cited a collection from Bent's Basin near Port Jackson collected by W. Woolls. Six sheets (four at MEL and one each at NSW and K) from the same locality with the same collector and labelled *B. pomaderroides* have been located. They all appear to be part of the original material used by Mueller to describe this species. The MEL sheet [MEL114101] is here selected as lectotype because it matches the description in the protologue and is annotated by Mueller.

***Notes*:** The collections *Constable* [NSW55744], *Mills* [NSW194898] and *Pearce* [NSW194897] (all in NSW) and *Bauerlen* [CANB383025] (CANB) have slightly larger leaves and a coarser indumentum than is typical for *B. pomaderroides*. Study of more material in the field is required to ascertain the significance of this variability.

22. Bertya recurvata Halford & R.J.F.Hend. **sp. nov.** arte affinis *B. gummiferae* Planch. ut videtur sed caulibus pilorum stellatorum indumento caduco non persistenti, foliis lamina adaxialiter

subtiliter non grosse tuberculata, et floribus femineis calycis lobis marginibus integris non ciliatis differt. In additamentis haec species affinis *B. pinifoliae* Planch. et *B. graniticae* Halford & R.J.F.Hend. Ab illa foliis lamina rotundata non glande apiculata ad apicem, latiore et proportione breviore (l/w ratio minus quam 20:1 non plus quam 30:1), et floribus femineis calycis lobis leviter magnioribus (4.7–5.1 mm non 2.9–3.6 mm longis) differt. Ab haec foliis lamina distaliter recurvata non stricta et floribus femineis calycis lobis marginibus integris non ciliatis differt. **Typus:** Queensland. DARLING DOWNS DISTRICT: Portion 90, Wyberba, 5 September 1993, *P.I. Forster & A.R. Bean* PIF13846 (holo: BRI; iso: AD, NSW, MEL, CANB, distribuendi).

Bertya sp. (Amiens L.Pedley 1488), Forster & Halford (2002, p. 69).

Monoecious or dioecious, much branched shrubs up to 1.5 m high, thinly viscid on most parts. Branchlets ± angular, becoming terete with age, glabrous or rarely sparsely stellate-pubescent on young shoots, soon becoming glabrous, finely tuberculate; hairs stipitate with stipes up to 0.1 mm long, white, 0.4–0.5 mm across. Leaves petiolate, spirally alternate, ascending to spreading; petiole ± bi-convex, 1–1.5 mm long, glabrous, smooth or sparsely tuberculate; lamina linear to lorate, 15–27 mm long, 1.5–2.6 mm wide, recurved at tip; adaxial surface green, glabrous, finely tuberculate; abaxial surface white, densely hairy with sessile and shortly stipitate stellate (0.3–0.6 mm across) and simple glandular (up to 0.05 mm long) hairs; margin recurved or revolute to midrib concealing abaxial leaf lamina surface; apex rounded; base cuneate; midvein faintly impressed or obscure adaxially, abaxially raised and angular, glabrous or with scattered stellate hairs on abaxial face, becoming glabrous, tuberculate, stellate-pubescent laterally; marginal glands present at base of lamina, 1 each side of midrib, 0.25–0.35 mm across, sessile. Inflorescences of a single flower or rarely umbelliform with 2 flowers, pedunculate, axillary or sometimes terminal on rudimentary, short branchlet in distal leaf axils; peduncles up to 1 mm long; bracts 3–8, persistent; outer bracts narrowly ovate or narrowly triangular, 2.7–3.5 mm long, 1–2.6 mm wide, obtuse to rounded at apex, glabrous, papillose; inner bracts narrowly ovate to broadly ovate, 2.4–2.9 mm long, 1.4–2.2 mm wide, obtuse, rounded or acuminate, glabrous. Male flowers sessile; calyx lobes 5, yellow-green coloured, oblong-elliptic, 4–5.3 mm long, 3.3–4.2 mm wide, rounded at tip, glabrous; androecium 5.5–7.0 mm long, 0.9–1.4 mm across; stamens 40–80; filaments 0.1–0.2 mm long; anthers 0.9–1.4 mm long. Female flowers sessile; calyx 5-lobed, yellow-green coloured; tube 0.5–0.7 mm long; lobes equal, ± erect and incurved distally, elliptic to oblong-elliptic or ovate, 4.7–5.1 mm long in flower, up to 11 mm long in fruit, 2.7–3.5 mm wide, rounded at tip, glabrous, with margins entire; petals absent or rudimentary when ovate, up to 0.8 mm long and 0.4 mm wide, and glabrous; ovary ovoid to subglobose, 1.4–2.4 mm long, 1.4–2.0 mm across, 3-locular, glabrous; style with glabrous column 0.5–0.8 mm long and 3 spreading limbs; limbs red, 4–6 mm long, 0.7–0.8 mm wide, deeply 2– to 4-lobed; lobes 3.0–4.5 mm long, 0.4–0.5 mm wide. Capsule ellipsoid, 7.5–8.2 mm long, 3.5–5.1 mm across, glabrous, usually 1– or 2-seeded; persistent calyx lobes usually longer than capsule. Seed obloid-ellipsoid, 5.0–5.8 mm long, 3.0–3.2 mm wide, 2.1–2.8 mm across, dark brown to dark reddish brown; caruncle pyramidal, 1.7–2.0 mm across, 1.3–1.6 mm long, creamy-white. Fig. 8.

***Selected specimens (from 19 examined)*: Queensland.** DARLING DOWNS DISTRICT: Wallangarra, Jan 1906, *Boorman* (NSW); Wallangarra, Jul 1904, *Boorman* (NSW); Girraween National Park, 15 km N of Wallangarra, Nov 1975, *Clifford* (NSW); Portion 90, Wyberba, Aug 1995, *Forster & Figg* PIF17595 (BRI); Bald Rock Creek, 2.5 km W of Girraween National Park Headquarters, Sep 1993, *Forster & Bean* PIF13843 (BRI); Girraween National Park, Bald Rock Creek area, Jan 1993, *Forster & Halford* PIF12640 (BRI); c. 5 miles [8 km] W of Wyberba near Girraween National Park, Oct 1975, *Hassall* 7579 (BRI); 8 km W of Wyberba, near Girraween National Park, Sep 1976, *Hassall* 7666 (BRI); near Girraween National Park, Apr 1975, *Hassall* 754 (BRI); Wyberba, in 1961, *Hockings* (BRI); Amiens, 10 miles [c. 16 km] NW of Stanthorpe, Oct 1963, *Pedley* 1488 (BRI, K); Girraween National Park near Wyberba, Sep 1970, *Ryan* 50 (BRI); on property of W. McDongah, Lyra, Oct 1962, *Shea* S122 (BRI); Bald Rock Creek, 10 km N of Wallangarra, Sep 1973, *Telford & Zander* 3195 (CANB); Bald Rock Creek, 10 km N of Wallangarra, Sep 1973, *Telford* 3194 (CANB).

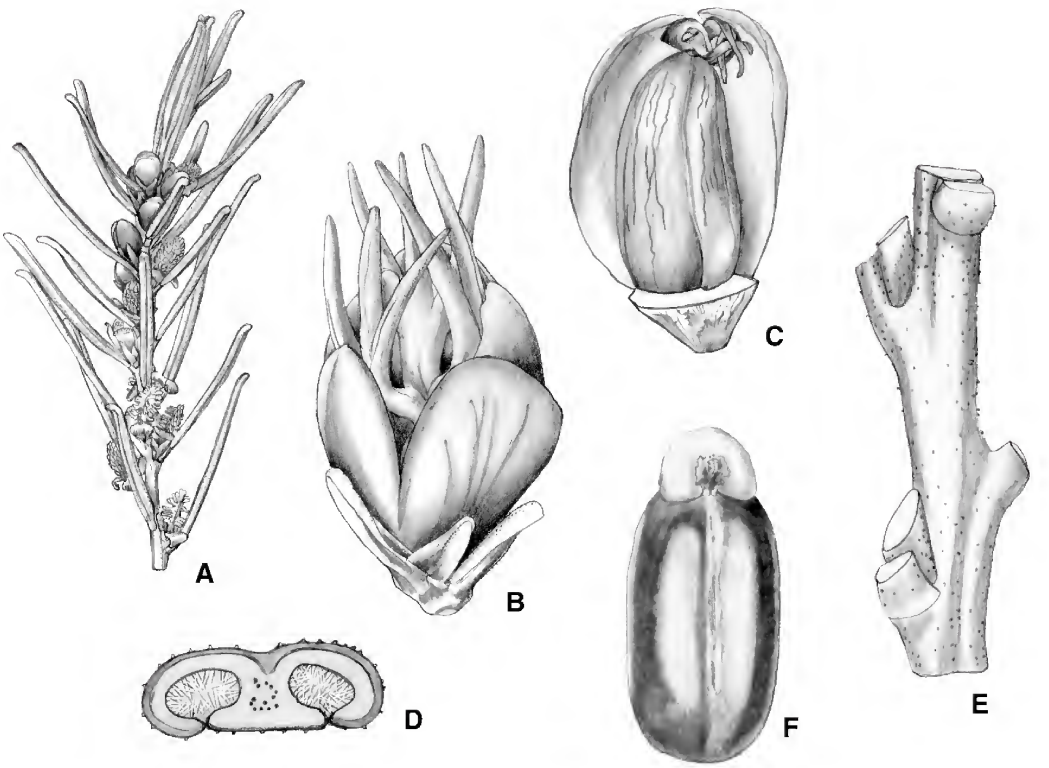


Fig. 8. ***Bertya recurvata.*** A. branchlet with male flowers. ×1. B. female flower from side. ×6. C. fruit from side with frontal enlarged persistent calyx lobes removed. ×4. D. transverse section of leaf. ×16. E. section of branchlet. ×6. F. ventral view of seed. ×6. A from *McDonald* s.n. 11 Sep 1990 (BRI); B, D & E from *Forster & Bean* PIF13846 (BRI); C & F from *Forster & Halford* PIF12640 (BRI). Del. W. Smith.

***Distribution and habitat*:** *Bertya recurvata* is confined to the south-east of Queensland where it is restricted to the Stanthorpe-Wallangarra area (Map 26). It is recorded as growing on shallow sandy soils on exposed granite outcrops in heath, dense shrubland, open *Callitris* woodland or open eucalypt forest or woodland communities.

***Phenology*:** Flowers have been recorded from July to October, fruits in January, April, October and November.

***Affinities*:** *Bertya recurvata* seems most closely allied to *B. gummifera* but differs from that by lacking a persistent indumentum of stellate hairs on the stems, finely tuberculate rather than coarsely tuberculate adaxial leaf lamina surfaces and entire rather than ciliate margins of the calyx lobes of female flowers.

B. recurvata is also similar to *B. pinifolia* and *B. granitica* but differs from the former in its leaves not being ultimately terminated by an apiculate gland, wider and proportionally shorter leaf laminas (leaf lamina length/width ratio less than 20:1 compared with greater than 30:1), and slightly larger calyx lobes in female flowers (4–7–5.1 mm long compared with 2.9–3.6 mm long). For differences from *B. granitica* refer to notes under that species.

***Etymology*:** The specific epithet is derived from Latin *recurvatus*, curved backwards, in reference to the recurved apex of the leaves of this species.

23. Bertya riparia Halford & R.J.F.Hend. **sp. nov.** arte affinis *B. tasmanicae* subsp. *vestitae* Halford & R.J.F.Hend. ut videtur sed foliis lamina latiore (2.4–4.4 mm non 0.9–2.1 mm lata) marginibus strictis non

recurvis ad costam, et inflorescentiis pedunculo longiore (1.5–2.5 mm non 0.7–1.4 mm longo) differt. **Typus:** New South Wales. 5 km SE of Macks Crossing along Stokes Hut Trail, Kosciusko National Park, 29 October 1993, *N. Taws* 216 & *A. Scott* (holo: BRI; iso: CANB, MEL, NSW).

Monoecious, much branched shrubs 1–2 m high. Branchlets terete, with a dense indumentum of stellate hairs; hairs sessile or stipitate on stipes up to 0.1 mm long, golden-yellow or grey-white, up to 0.6(1.0) mm across. Leaves petiolate, spirally alternate, spreading; petiole plano-convex, 1.5–3 mm long, with a moderately dense, stellate hairy indumentum up to 0.1 mm thick; lamina narrowly obovate or linear, 21–29 mm long, 2.4–4.4 mm wide; adaxial surface green, with a sparse to moderately dense indumentum of stellate hairs, glabrescent, smooth or with scattered tubercules (persistent hair bases); abaxial surface white, densely hairy with stipitate stellate hairs 0.4–0.5 mm across; margin recurved; apex rounded to obtuse; base cuneate; midvein impressed adaxially, abaxially raised and ± rounded, densely stellate-pubescent; marginal glands present at base of lamina, 1 each side of midrib, c. 0.1 mm across, sessile. Inflorescences of a single flower or umbelliform with 2 flowers, pedunculate, axillary; peduncles 1.5–2.5 mm long; bracts 5–8, persistent; outer bracts triangular, 2.9–3.2 mm long, 1.7–2.2 mm wide, acute to acuminate at tip, stellate-pubescent abaxially, glabrous or stellate-pubescent distally adaxially; inner bracts narrowly ovate to ovate, 3.5–4.0 mm long, 1.3–1.5 mm wide, acute at tip, glabrous except for stellate hairs distally abaxially. Male flowers sessile; calyx lobes 5, of unknown colour when fresh, elliptic, 3-4 mm long, 2–2.5 mm wide, rounded at tip, glabrous adaxially, stellate-pubescent abaxially; androecium c. 2 mm long, 0.5–0.6 mm across; stamens c. 30; filaments 0.1–0.2 mm long; anthers 0.7–0.8 mm long. Female flowers sessile; calyx 5-lobed, of unknown colour when fresh; tube 0.8–0.9 mm long; lobes ± equal or inner lobes slightly narrower, erect, spreading to recurved distally, narrowly ovate to ovate, 3.2–4.2 mm long, 1.4–2.1 mm wide, acute at tip, glabrous adaxially sparsely stellate-pubescent abaxially, with margins fimbriate; petals absent; ovary ovoid, 1.8–2.2 mm long, 1.5–2 mm across, 3-locular, densely stellate-pubescent; style with hairy column 0.1–0.3 mm long and 3 spreading limbs; limbs red, 1.6–3.1 mm long, c. 0.3 mm wide, deeply 3– or 4-lobed; lobes 1.5–2.3 mm long, 0.1–0.2 mm wide. Mature capsule and seed not seen. Fig. 9 & 10.

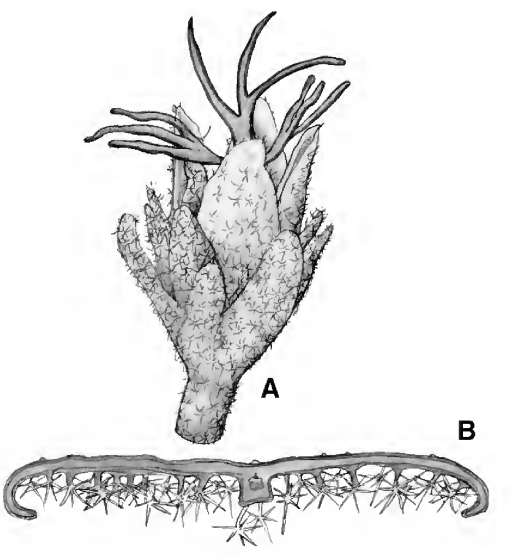


Fig. 9. ***Bertya riparia***. A. female flowers from the side. ×6. B. transverse section of leaf. ×12. A & B from *Taws* 216 & *Scott* (BRI). Del. W. Smith.

***Additional specimens*: New South Wales.** Brindabella, 1 km along track following Goodradigbee River downstream, Feb 1984, *James & Taylor* 537 (NSW); Crown Reserve 13 km directly ESE of Tumut, S bank of Goobarragandra River, Jan 1994, *Taws* 372 & *Scott* (BRI, CANB, NSW); c. 16.5 km directly ESE of Tumut, beside Goobarragandra River, 50 m downstream from suspension bridge, Dec 1993, *Taws* 298 (BRI, CANB); junction of Flea Creek and Goodradigbee River, downstream from Brindabella, Sep 1973, *Whaite* 3538 (CANB, NSW).

***Distribution and habitat*:** *Bertya riparia* is confined to the Southern Tablelands of New South Wales where it occurs from near Tumut eastward to Brindabella (Map 27). It is recorded from riparian habitats in open forest or woodland communities on grey sandy, dark brown sandy clay or dark brown loam soils where it is associated with *Leptospermum* spp. *Callistemon sieberi* DC., *Pomaderris angustifolia* Wakef., *Bursaria spinosa* Cav.,

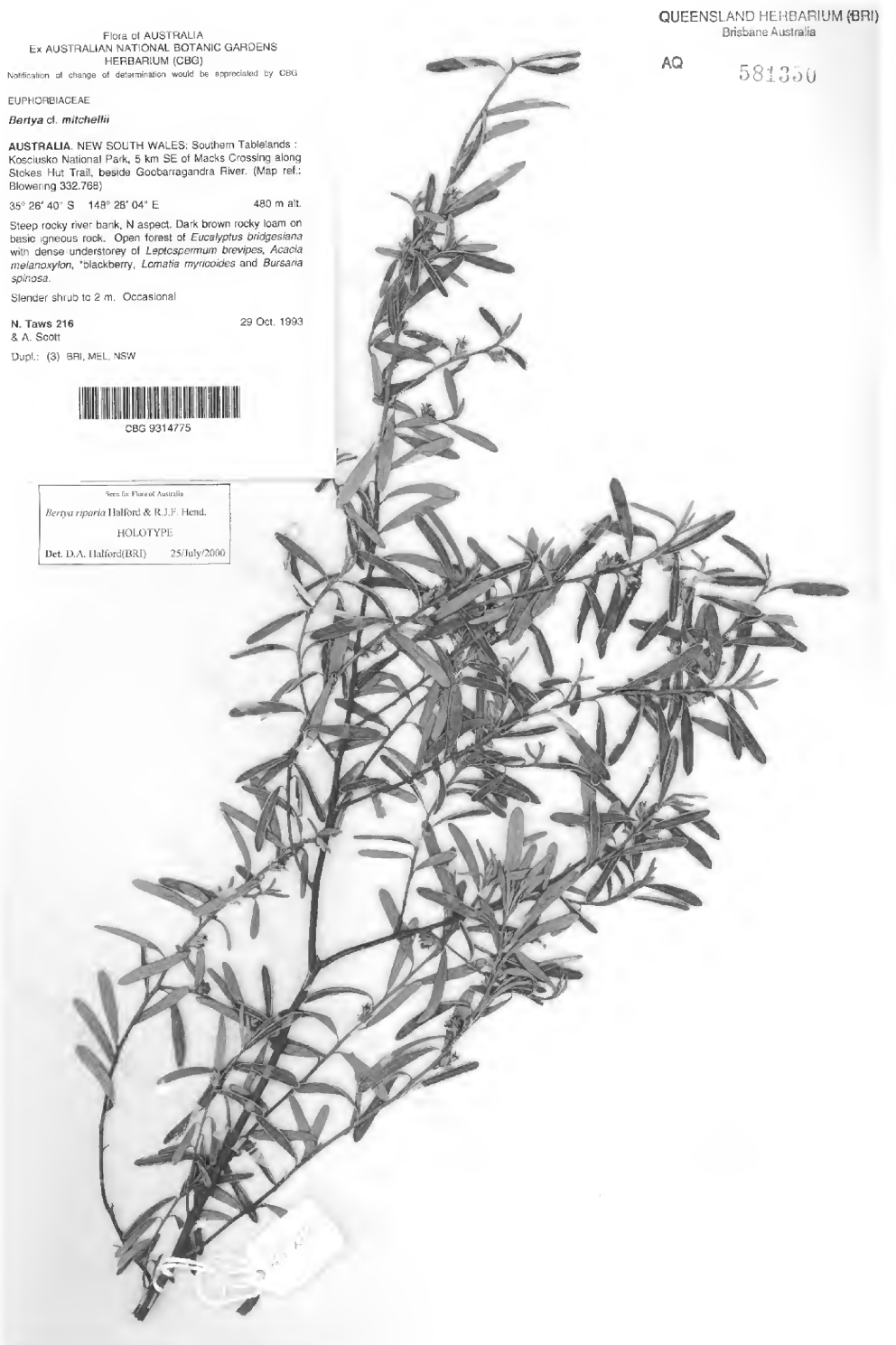


Fig. 10. Holotype of ***Bertya riparia***.

Acacia spp., *Lomandra longifolia* Labill. and/or *Rubus* spp.

***Phenology*:** Flowers have been recorded in February, September and October, mature fruits have apparently not been collected.

***Affinities*:** *Bertya riparia* seems most closely related to *B. tasmanica* subsp. *vestita* but differs from that by its wider leaves (2.4–4.4 mm wide compared with 0.9–2.1 mm wide) with margins not recurved to midrib and slightly longer peduncles (1.5–2.5 mm long compared with 0.7–1.4 mm long).

***Etymology*:** The specific epithet is from Latin *riparius*, meaning frequenting banks of streams or rivers, in reference to the habitat in which this species grows.

24. Bertya rosmarinifolia Planch., London J. Bot. 4: 473, t. 16, fig. 2-5 (1845). **Type:** [New South Wales.] Channel of Cox's River, [October 1822,] [*A. Cunningham*] (lecto, here chosen: K (ex herb. Hook.); isolecto: K (ex herb. Benth.)).

Croton rosmarinifolius A.Cunn. in B. Fields, Geographical Memoirs on New South Wales. 355 (1825), *nom. illeg.*, non Salisb., Prod. 389 (1796). **Type:** [New South Wales.] Channel of Cox's River, [October 1822,] [*A. Cunningham*] (lecto, here chosen: K (ex herb. Hook.); isolecto: K (ex herb. Benth.)).

Bertya polymorpha forma *rosmarinifolia* Baill., Adansonia 6: 300 (1866). **Type:** [New South Wales.] Channel of Cox's River, [October 1822,] [*A. Cunningham*] (lecto, here chosen: K (ex herb. Hook.); isolecto: K (ex herb. Benth.)).

Monoecious or dioecious, much branched shrubs up to 2 m high, viscid on buds, flowers and sometimes on young leaves. Branchlets ± angular, becoming terete with age, with a dense indumentum of stellate hairs, becoming glabrous with age; hairs ± sessile, white to grey-white, 0.1–0.5 mm across. Leaves petiolate, spirally alternate or subopposite, ascending; petiole plano-convex, 0.8–1.8 mm long, glabrous adaxially, with a dense stellate-pubescent indumentum up to 0.1 mm thick abaxially; lamina lorate to linear, 7–25 mm long, 0.8–1.6 mm wide, slightly recurved at tip; adaxial surface dark green, with scattered stellate hairs, glabrescent, smooth or sparsely punctate; abaxial surface white, densely hairy with sessile stellate hairs 0.2–0.4 mm across; margin recurved to midrib concealing abaxial surface; apex rounded to truncate or retuse, usually ultimately terminated by a sessile gland; base obtuse to cuneate; midvein slightly impressed or raised adaxially, abaxially raised and angular, stellate-pubescent; marginal glands present at base of lamina, 1 or 2 each side of midrib, c. 0.1 mm across, sessile. Inflorescences of a single flower, pedunculate, axillary; peduncles 0.9–2.5 mm long; bracts 6–8, persistent; outer bracts ovate or oblong, 0.6–1.7 mm long, 0.4–0.7 mm wide, rounded to obtuse at tip, glabrous adaxially, stellate-pubescent abaxially; inner bracts, ovate to narrowly ovate, 0.9–1.1 mm long, 0.4–0.6 mm wide, acute at tip, glabrous or with scattered stellate hairs abaxially. Male flowers sessile; calyx lobes 5, light green or yellow-green with a reddish coloured blush distally, ovate-elliptic or oblong-elliptic, 2.7–3.5 mm long, 1.5–2.5 mm wide, rounded at tip, glabrous; androecium 2.8–3.5 mm long, 0.4–0.5 mm across; stamens 16–25; filaments up to 0.1 mm long; anthers 0.7–1 mm long. Female flowers sessile; calyx 5-lobed, light green tinged red to maroon coloured distally; tube 0.5–0.9 mm long; lobes ± equal, erect, recurved to revolute distally, ovate to oblong-ovate, 2.1–3.5 mm long, 0.8–1.4 mm wide, acute to obtuse at tip, glabrous, with margins entire; petals absent or rudimentary when narrowly ovate or narrowly obovate, up to 1.2 mm long and 0.3 mm wide, glabrous; ovary ellipsoid, 1.3–1.6 mm long, 1.2–1.5 mm across, 3-locular, stellate-pubescent; style with hairy column 0.2–0.3 mm long and 3 spreading limbs; limbs red, 1.7–2.8 mm long, c. 0.4 mm wide, deeply 2– or 3(rarely 4)-lobed; lobes 1.0–2.5 mm long; 0.1–0.2 mm wide. Capsule ovoid to ovoid-ellipsoid, 4.5–6.2 mm long, 2.7–3.1 mm across, ± glabrous or sparsely stellate-pubescent, usually 1-seeded; persistent calyx lobes ≤ half the capsule length. Seed obloid, 3.2–3.5 mm long, 2.8–2.9 mm wide, 1.5–1.7 mm across, light brown; caruncle pyramidal, c. 0.7 mm across, c. 0.5 mm long, creamy-white.

***Selected specimens (from 60 examined)*: Queensland.** DARLING DOWNS DISTRICT: Stanthorpe, Jul 1904, *Boorman* (NSW); Stanforth [Stanthorpe], Nov 1943, *Clemens* (BRI); Stanthorpe, Quart Pot Creek, *Halford* Q3834 (BRI). **New South Wales.** Shoalhaven River, 200 m downstream from Warri Bridge, Sep 1989, *Butler* 1612 (CANB); Mt McDonald, near Lachlan River, Aug 1900, *Cambage* (NSW); Walcha, Oct 1899, *Campbell* (AD, BRI, NSW); Shoalhaven River, 9 miles [c. 14 km] NW of Braidwood, Nov 1970, *Common & Dugdale* (CANB); WNW of Glen Innes via Wellingrove in the Kings Plains National Park, Feb 1994, *Coveny & Whalen* 16624 (BRI, NSW); Apsley Falls, Oxley Wild Rivers National Park, c. 19 km WSW of Walcha, Sep 1990, *Henderson & Turpin* H3408 (BRI); *ditto*, Sep 1990, *Henderson & Turpin* H3407 (BRI); head of Apsley Falls, Oct 1953, *Johnson* (NSW); Inverell, Aug 1905, *Maiden & Boorman* (NSW); Cox's River, Oct 1904, *Maiden & Cambage* (NSW); Tallowa Dam, Shoalhaven River, Oct 1985, *Mills* (NSW); 10 miles [c. 16 km] from Braidwood towards Goulburn, Sep 1972, *Salasoo* 5055 (NSW); Dangar's Falls, 20 km SSE of Armidale, Sep 1988, *Telford* 10712 (BRI, CANB, MEL); Stony Creek Falls, E of Walcha, Oct 1966, *Wissmann* (NE). **Australian Capital Territory.** Queanbeyan River E of Wickerslack Lane, Apr 1997, *Crawford* 4312 (CANB, NSW); Molonglo River near Oaks Estate, below River Street, Nov 1989, *Hadobas & Matthews* 106 (CANB, NSW).

***Distribution and habitat*:** *Bertya rosmarinifolia* occurs in eastern Australia from Stanthorpe, Queensland, southwards to Kameruka in southern New South Wales (Map 28). It is recorded from shrubland communities on rocky river banks or rarely on rocky mountain ridges. Soils are recorded as shallow mostly alluvial sand or loam.

***Phenology*:** Flowers have been recorded from July to October, with one record in February, fruits from October to December.

***Affinities*:** *Bertya rosmarinifolia* is superficially similar to *B. tasmanica* but can be distinguished from that by its generally narrower, linear to linear-oblong leaf laminas and its truncate to rounded leaf apex.

***Typification*:** In the protologue of *Bertya rosmarinifolia*, Planchon (1845) cited two syntypes 'Juxta amnem, Cox' and 'in montibus coeruleis' both collected by A. Cunningham. At the time Planchon was an assistant to W.J. Hooker at Kew. In the material on loan to BRI from K we have located two specimens collected by Alan Cunningham on two separate sheets that are both stamped as originating from Hooker's herbarium. Although neither sheet is clearly annotated by Planchon with the name *B. rosmarinifolia*, both are considered to be part of the original material used by Planchon when describing the species. One specimen has a field label attached to the specimen stating '*Croton rosmarinifolia* C, handsome shrub to 8 feet high, Channel of Cox's River', while the other has the following information written on the sheet beside the specimen: 'Blue Mount, Nov. Holl., *B. rosmarinifolia* Müll.Arg.!, *B rosmarinifolia* Planch.'.

We have chosen to lectotypify the name *B. rosmarinifolia* Planch. by the specimen originating from Hooker's herbarium labelled 'Channel of Cox's River'. A third specimen at K, on a sheet stamped as originating from Bentham's herbarium, appears to be a duplicate of the specimen from Hooker's herbarium here chosen as lectotype for Planchon's name though it bears Cunningham's collecting number 64 whereas the others are without a collecting number.

Cunningham's *Croton rosmarinifolius* is illegitimate being a later homonym of Salisbury's *Croton rosmarinifolius* of 1796, a name which applies to a different species from the West Indies.

25. Bertya rotundifolia F.Muell., Fragm. 4: 34 (1863). **Type:** [South Australia.] Cygnet River, Kangaroo Island, [without date,] *F. Waterhouse* (holo: MEL [MEL114120]; iso: K).

Illustration: J.Z. Weber (1986: p. 740, fig. 397B).

Monoecious or sometimes dioecious, much branched shrubs up to 2 m high. Branchlets ± terete, with a dense indumentum of stellate hairs, becoming glabrous with age; hairs sessile or stipitate with stipes up to 1.5 mm long, white, 0.2–0.7 mm across. Leaves petiolate, spirally alternate, spreading; petiole plano-convex, 1.4–2.5 mm long, glabrous and smooth above, with a dense stellate-pubescent indumentum up to 0.4 mm thick below; lamina ovate or orbicular, 5–10 mm long, 3–8 mm wide; adaxial surface green, sparsely hairy with stipitate stellate hairs 0.3–0.7 mm across, glabrescent, tuberculate with persistent hair bases; abaxial surface white, densely hairy with sessile and stipitate hairs 0.2–0.5 mm across;

margin recurved; apex obtuse to rounded; base obtuse or sometimes slightly cordate; midvein obscure or slightly impressed adaxially, abaxially raised; marginal glands usually present at base of lamina, 1 each side of midrib, c. 0.1 mm long, ± sessile. Inflorescences of a single flower, pedunculate, axillary; peduncles 0.5–0.8 mm long; bracts 4–8, persistent; outer bracts ovate, 1.1–2 mm long, 0.7–1.5 mm wide, obtuse to rounded at tip, stellate-pubescent abaxially; inner bracts ovate to broadly ovate, 0.9–1.1 mm long, 0.5–1.1 mm wide, obtuse at tip, glabrous or with scattered stellate hairs abaxially. Male flowers sessile; calyx lobes 5, brown, ovate or ovate-elliptic, 1.5–3 mm long, 1.3–2.2 mm wide, obtuse to rounded at tip, glabrous; androecium 1.9–3.0 mm long, 0.4–0.5 mm across; stamens 18–25; filaments c. 0.1 mm long; anthers 0.6–0.8 mm long. Female flowers subsessile; calyx 5-lobed, yellow-green coloured; tube 0.5–0.7 mm long; lobes equal, erect, recurved distally, narrowly ovate to ovate, 1.5–2.2 mm long, 0.7–1.5 mm wide, acute or obtuse at tip, glabrous or with a sparse indumentum of stellate hairs abaxially, glabrous adaxially, with margins entire; petals absent; ovary subglobose, c. 1.5 mm long, c. 1.5 mm across, 3-locular, stellate-pubescent; style with glabrous column 0.3–0.5 mm long and 3 spreading limbs; limbs red, 1.6–2.2 mm long, c. 0.2 mm wide, deeply 2– or 3-lobed; lobes 1.2–1.6 mm long, c. 0.1 mm wide. Capsule ovoid to ellipsoid, 6–7 mm long, 3.5–4 mm across, with a moderately dense indumentum of stellate hairs, glabrescent, 1-seeded; persistent calyx lobes ≤ half the capsule length. Seed obloid or ellipsoid, 4.3–5.5 mm long, 2.5–3.8 mm wide, 2.2–3.3 mm across, light brown and mottled with grey, dark brown and black; caruncle pyramidal, 1.0–2.1 mm across, 1.2–1.5 mm long, yellowish-white. Kangaroo Island Bertya.

***Selected specimens (from 68 examined)*: South Australia.** Muston, Kangaroo Island, Aug 1943, *Cooper* (AD); Kingscote-Penneshaw road, c. 11 km WSW of American River, Dec 1989, *Davies* 1491 (CANB, MEL, NSW); c. 13 km S of Kingscote, Nov 1958, *Eichler* 15263 (AD); Cygnet River Bridge on Amen Corner to Kohinoor Road, c. 2 km NW of junction with Playford Highway, Aug 1982, *Jackson* 4529 (AD); c. 3 km along 3-Chain Road from Kingscote-Penneshaw road, Sep 1994, *Jones & Jones* 13280 (CANB); Kangaroo Island, 1 km N of Flour Cask Bay, Jun 1986, *Kraehenbuehl* (MEL); Hundred of Haines, Kangaroo Island, Jun 1989, *Lang* 8497 (BRI); near American River, Kangaroo Island, Nov 1973, *Nelson* ANU17289 (AD, CANB); near Destree Bay, Kangaroo Island, Aug 1964, *Phillips* (CANB); Stoke's Bay Road, Kangaroo Island, Oct 1976, *Spooner* 4782 (AD); near Birchmore Lagoon, 21 km SW of Kingscote, Nov 1958, *Wilson* 892 (AD).

***Distribution and habitat*:** *Bertya rotundifolia* is confined to South Australia where it is restricted to Kangaroo Island (Map 29). It is recorded as growing in coastal shrubland or open woodland communities on sandy soils.

***Phenology*:** Flowers have been recorded in February, from May to October and in December, fruits from August to December.

26. Bertya sharpeana Guymer, Austrobaileya 2(5): 427 (1988). **Type:** Queensland. Moreton District: Mt Coolum, 14 August 1982, *G.P. Guymer* 1771 (holo: BRI; iso: AD *n.v.*, BRI, CANB, K *n.v.*, MEL *n.v.*, NSW, PERTH *n.v.*, *fide* Guymer, *loc. cit.*).

Illustration: G.P. Guymer (1988: p. 428, fig. 1).

Monoecious or dioecious, much branched shrubs up to 4 m high. Branchlets terete, with a dense indumentum of stellate hairs, becoming glabrous with age though remaining tuberculate by persistent hair bases; hairs stipitate with stipes 0.1–0.8 mm long, white, 0.7–1.3 mm across. Leaves petiolate, spirally alternate, spreading; petiole plano-convex, 1–4 mm long, slightly grooved adaxially, with a dense stellate-pubescent indumentum up to 2.5 mm thick; lamina narrowly ovate to ovate, 8–22 mm long, 3–10 mm wide; adaxial surface green, sparsely hairy with stipitate stellate hairs 0.3–1.0 mm across, glabrescent, tuberculate with persistent hair bases; abaxial surface white, densely hairy with stipitate stellate hairs 0.3–0.7 mm across; margin recurved or flat; apex obtuse to acute; base obtuse or slightly cordate; midvein slightly impressed adaxially, abaxially raised and angular or rounded, stellate-pubescent; marginal glands usually present at base of lamina, 1 each side of midrib, c. 0.1 mm across, stipitate with stipes 0.2–0.7 mm long. Inflorescences of a single flower, pedunculate, axillary; peduncles 0.5–0.7 mm long; bracts 5–9, persistent; outer bracts narrowly ovate to broadly ovate, 1.2–1.6 mm

long, 0.7–1.7 mm wide, acute or acuminate at tip, glabrous or stellate-pubescent distally adaxially, stellate-pubescent abaxially; inner bracts broadly ovate to orbicular, 1.1–1.6 mm long, 1.3–1.7 mm wide, obtuse to rounded at tip, glabrous or stellate-pubescent distally abaxially. Male flowers sessile; calyx lobes 5, white with a pinkish-coloured blush, turning reddish-pink with age, elliptic to oblong-elliptic, 2.5–4 mm long, 1.5–2 mm wide, rounded at tip, glabrous; androecium 3.0–4.0 mm long, 0.4–0.5 mm across; stamens 47–53; filaments c. 0.1 mm long; anthers 0.4–1 mm long. Female flowers sessile; calyx 5-lobed, light green coloured; tube 0.3–0.4 mm long; lobes equal, erect, recurved distally, ovate to oblong-ovate, 1.0–2.7 mm long, 0.8–1.8 mm wide, rounded to obtuse at tip, glabrous, with margins mostly fimbriate; petals absent or rudimentary when ovate or obovate, up to 0.8 mm long and 0.4 mm wide, glabrous; ovary globose, 0.8–0.9 mm long, 0.8–0.9 mm across, 3-locular, sparsely to densely stellate-pubescent; style with hairy column c. 0.1 mm long and 3 spreading limbs; limbs red to maroon, 1.1–4.5 mm long, deeply 2– to 4-lobed; lobes 0.6–3.5 mm long, 0.1–0.4 mm wide. Capsule narrowly ellipsoid or narrowly ovoid, 4–8 mm long, 2.4–3.5 mm across, sparsely stellate-pubescent, 1-seeded; persistent calyx lobes ≤ half the capsule length. Seed obloid-ellipsoid, 3.1–4.5 mm long, 2.0–2.9 mm wide, 2.3–2.7 mm across, light brown and mottled with dark brown; caruncle pyramidal, c. 1.8 mm across, c. 1.1 mm long, creamy-white.

***Selected specimens (from19 examined)*: Queensland.** North Kennedy District: Roma Peak, c. 40 km S of Bowen, Jun 1991, *Bean* 3365 (BRI, CANB); *ditto*, Jun 1991, *Bean* 3360 (BRI, NSW). South Kennedy District: Dick's Tableland, Eungella National Park, Aug 1990, *Pearson* 364 (BRI). Leichhardt District: Diamond Cliffs, Sydney Heads, W of Mackay, Feb 1990, *Pearson* E205 (BRI). Moreton District: Mt Coolum, Sep 1989, *Batianoff* 890905 (BRI, NSW); *ditto*, Aug 1982, *Guymer & Sharpe* 1768 (BRI, NSW); *ditto*, Jul 1982, *Sharpe* 3213 (BRI, NSW); *ditto*, Sep 1981, *Sharpe & Batianoff* 2992 (BRI, NSW); *ditto*, Nov 1981, *Sharpe* 3049 (BRI, NSW).

***Distribution and habitat*:** *Bertya sharpeana* has a disjunct distribution in central and south-eastern Queensland from near Bowen, Mackay and Nambour (Map 30). It is recorded as growing on rhyolitic outcrops mostly in heath but occasionally in open forest or woodland communities or on rainforest margins. Soils are recorded as skeletal dark brown organic loams.

***Phenology*:** Flowers have been recorded from June to September and in November, fruits in August, September and November.

***Notes*:** The northern populations of *B. sharpeana* tend to have slightly longer and broader leaf laminas and larger female flowers than those from the type locality at Mt Coolum, south-east Queensland.

27. Bertya tasmanica (Sond. & F.Muell.) Müll.Arg., Linnaea 34: 63 (1865); *Ricinocarpos tasmanicus* Sond. & F.Muell., Linnaea 28: 562 (1857). **Type:** Tasmania, [without date,] *C. Stuart* (holo: MEL (ex herb. Sonder) [MEL2065834]; iso: G-DC *n.v.*, microfiche IDC 800-73. 2456: I. 6).

Monoecious or sometimes apparently dioecious, much branched shrubs up to 2.5 m high, sometimes thinly viscid on buds and flowers. Branchlets ± angular, becoming terete with age, with a dense indumentum of stellate hairs, becoming glabrous with age; hairs ± sessile or stipitate with stipes up to 0.1 mm long, white to grey-white or golden brown, 0.1–0.3(0.6) mm across. Leaves petiolate, spirally alternate, ascending to spreading; petiole ± bi-convex or plano-convex, 1.0–3.1 mm long, with a dense stellate-pubescent indumentum up to 0.1 mm thick on both surfaces or glabrous adaxially; lamina lorate to linear, 8–32 mm long, 1.2–1.6 mm wide; adaxial surface green to grey-green, with a sparse to moderately dense indumentum of stellate hairs up to 0.4 mm across, glabrescent, smooth, sparsely punctate or minutely tuberculate with persistent hair bases; abaxial surface white, densely hairy with sessile or shortly stipitate stellate hairs 0.1–0.5 mm across; margin recurved or revolute to midrib concealing abaxial surface; apex obtuse to acute, rarely apiculate with extension from mibrib up to 0.5 mm long; base cuneate or obtuse; midvein obscure, raised or slightly impressed adaxially, abaxially raised and angular to rounded, stellate-pubescent; marginal glands present at base of lamina, 1

each side of midrib, c. 0.1 mm across, sessile or stipitate with stipes up to 0.1 mm long. Inflorescences of a single flower or rarely umbelliform with 2 flowers, pedunculate, axillary; peduncles 0.7–2.0 mm long; bracts 5–9, persistent; outer bracts ovate to narrowly ovate or oblong, 1.4–3.4 mm long, 0.6–1.7 mm wide, densely stellate-pubescent on both surfaces or glabrous adaxially; inner bracts ovate to broadly ovate, orbicular or lanceolate, 1.2–2.4 mm long, 0.7–1.7 mm wide, glabrous except for stellate hairs on midline of abaxial surface. Male flowers ± sessile; calyx lobes 5, yellowish coloured with a reddish blush distally, ovate, elliptic or oblong-elliptic, 2.4–5.1 mm long, 2.0–3.2 mm wide, rounded at tip, glabrous or with scattered stellate hairs on margin or along midline adaxially; androecium 1.6–3.0 mm long, 0.3–0.9 mm across; stamens 15–55; filaments 0.1–0.2 mm long; anthers 1.0–1.3 mm long. Female flowers ± sessile; calyx 5-lobed, light green but tinged red to maroon distally; tube 0.5–0.8 mm long; lobes ± equal, erect, recurved or revolute distally, narrowly ovate to ovate or narrowly triangular, 1.8–4.3 mm long in flower, up to 6 mm long in fruit, 0.7–1.9 mm wide, acute or rarely rounded at tip, glabrous or sparsely to densely stellate-pubescent abaxially, with margins entire or fimbriate; petals absent or rudimentary when up to 0.2 mm long and 0.1 mm wide, glabrous; ovary ellipsoid, 1.3–2.2 mm long, 1.1–1.7 mm across, 3(rarely 4)-locular, densely stellate-pubescent to tomentose, rarely glabrous; style with hairy column 0.1–0.6 mm long and 3(rarely 4) spreading limbs; limbs maroon or pale yellow, 1.6–2.9 mm long, 0.3–0.4 mm wide, deeply 2- to 4-lobed; lobes 1.0–2.3 mm long, 0.1–0.2 mm wide. Capsule ellipsoid or narrowly ovoid, 5.6–8.0 mm long, 3.1–4.1 mm across, with a sparse to dense indumentum of stellate hairs or rarely glabrous, 1-seeded; persistent calyx lobes ≤ half the capsule length. Seed obloid, 3.9–5.2 mm long, 2.0–3.4 mm wide, 1.8–3.1 mm across, light brown; caruncle pyramidal, 1.1–1.5 mm across, 0.6–0.9 mm long, yellowish-white.

***Distribution*:** *Bertya tasmanica* is widespread in south-east Australia from near Kimba, South Australia eastwards to Coonabarabran and the Southern Tablelands, New South Wales, southward to the east coast of Tasmania.

***Notes*:** As circumscribed here *Bertya tasmanica* includes the taxon that has previously been known by the misapplied name *B. mitchellii*.

Two geographically disjunct taxa are recognizable within *B. tasmanica* as accepted here. These taxa are here recognized as subspecies which can be distinguished using the following key.

Calyx lobes of female flowers glabrous **27a. B. tasmanica** subsp. **tasmanica**
Calyx lobes of female flowers sparsely to densely stellate-pubescent
..... **27b. B. tasmanica** subsp. **vestita**

27a. Bertya tasmanica (Sond. & F.Muell.) Müll.Arg. subsp. **tasmanica**

Monoecious or sometimes dioecious shrubs, usually thinly viscid on buds and flowers. Stellate hairs ± sessile, white to grey-white, 0.1–0.3 mm across. Leaves spreading; petiole glabrous adaxially, with a dense indumentum up to 0.1 mm thick on abaxial surface; lamina with adaxial surface green, sparsely hairy with stellate hairs, glabrescent, smooth or sparsely punctate; apex obtuse to acute, sometimes ultimately terminated by a sessile gland; midvein slightly impressed adaxially. Inflorescences of a single flower, axillary. Male flowers with calyx lobes ovate or elliptic, 2.4–3.3 mm long, 2–2.4 mm wide, glabrous, and stamens c. 27. Female flowers with calyx lobes narrowly ovate to ovate, 1.8–3.6 mm long, acute at tip, glabrous, with margins entire; petals absent or rudimentary when up to 0.2 mm long and 0.1 mm wide; ovary 3-locular, stellate-tomentose; style with 3 spreading limbs; limbs deeply 2– or 3-lobed. Capsule 5.6–6.5 mm long, 3.5–3.7 mm across, with a moderately dense indumentum of stellate hairs. Seed 3.9–4.3 mm long, 2.0–2.2 mm wide, 1.8–2.1 mm across.

***Selected specimens (from 15 examined)*: Tasmania.** Old Coles Bay Road, c. 100 m SE of Apsley River old bridge, Nov 1990, *Buchanan* 11810 (BRI, CANB, MEL, NSW); Apsley River, old bridge on Coles Bay road, Sep 1983, *Crowden* (AD, HO, MEL); Apsley River, c. 1 km up road NE from Tasman Highway Junction - Coles Bay road, Oct 1990, *Henderson & Turpin* H3447 (BRI); *ditto*, Oct 1990 *Henderson & Turpin* H3446 (BRI); road to Coles Bay, Freycinet Peninsula, Nov 1960, *Phillips* (CANB); on banks of Swan and Cygnet Rivers, *Story* (MEL).

***Distribution and habitat*:** *Bertya tasmanica* subsp. *tasmanica* is confined to the east coast of Tasmania where is it restricted to near Bicheno and Cranbrook (Map 31). It is recorded as growing in riparian habitats in heath or woodland communities with a dense shrubby understorey on sandy soils.

***Phenology*:** Flowers have been recorded from September to November, fruits in November.

***Affinities*:** *Bertya tasmanica* subsp. *tasmanica* is similar to *B. rosmarinifolia* with which it shares a similar habitat. It differs from *B. rosmarinifolia* in having obtuse to acute rather than rounded to truncate or retuse leaf laminas which are slightly wider and more attenuate proximally and distally and petioles spreading rather than somewhat appressed to branchlets.

27b. Bertya tasmanica subsp. **vestita** Halford & R.J.F.Hend. **subsp. nov.** ab *B. tasmanica* (Sond. & F.Muell.) Müll.Arg. subsp. *tasmanica* floribus femineis calycis lobis stellato-pubescentibus non glabris differt. **Typus:** Victoria. c. 18 km SSE of Walpeup, on road to Hopetoun, September 1989, *Henderson & Turpin* H3277 (holo: BRI; iso: AD, MEL, according to label information on holotype)

Bertya mitchellii var. *vestita* Grüning in A.Engler, Pflanzenr. H.58: 61 (1913). Type: Victoria, [without date,] *F. Mueller* (syn: *n.v.*); Murray Desert, [without date,] *F. Mueller* (syn: *n.v.*; ?isosyn: MEL (ex herb. Sonder) [MEL2062917], CANB [CANB258548]); Lake Albacutya, [without date,] *C. French* (syn: *n.v.*); Wimmera Distr., [without date,] *F. Mueller* (syn: *n.v.*).

***Illustrations*:** L. Costermans (1986, p. 211) as *Bertya mitchellii*; M.G. Corrick and B.A. Fuhrer (2000, p. 82) as *Bertya mitchellii*.

Monoecious (some plants prominently male or female) shrubs, not viscid. Stellate hairs sessile or stipitate with stipes up to 0.1 mm long, grey-white or rarely golden brown, up to 0.2(0.6) mm across. Leaves ascending to spreading; petiole with a dense indumentum up to 0.1 mm thick on all surfaces; lamina with adaxial surface green to grey-green, with a sparse to moderately dense indumentum of stellate hairs, glabrescent, minutely tuberculate with persistent hair bases; apex acute to obtuse, rarely apiculate by extension from midrib up to 0.5 mm long; midvein obscure, raised or slightly impressed adaxially. Inflorescences of a single flower or rarely umbelliform with 2 flowers, axillary. Male flowers with calyx lobes elliptic to oblong-elliptic, 3.2–5.1 mm long, 1.9–3.2 mm wide, glabrous or with scattered stellate hairs on margin or along midline adaxially, and stamens (15–)30–55. Female flowers with calyx lobes narrowly ovate or narrowly triangular, 2.3–4.3 mm long, acute or rarely rounded at tip, glabrous adaxially, sparsely to densely stellate-pubescent (sometimes glabrous towards margins) abaxially, with margins fimbriate; petals absent; ovary 3(rarely 4)-locular, sparsely to densely stellate-pubescent, rarely glabrous; style 3(rarely 4) spreading limbs; limbs deeply (rarely 2–) 3– or 4-lobed. Capsule 6.4–8 mm long, 3–4.1 mm across, with a sparse to dense indumentum of stellate hairs or rarely glabrous. Seed 4.5–5.2 mm long, 2.5–3.4 mm wide, 2.3–3.1 mm across.

***Distribution and habitat*:** *Bertya tasmanica* subsp. *vestita* occurs from near Kimba, South Australia, eastwards to Swan Hill in north-western Victoria, with disjunct populations in the Coonabarabran area and Southern Tablelands of New South Wales and East Gippsland in Victoria (Map 32). It is recorded mostly as growing on sand plains or sand dune crests in mallee heath, tall shrubland, open woodland or open heath communities on deep white, red or yellow-brown sand, but also between sand dunes in mallee heath

communities on clay soils. In the eastern part of its range, this subspecies is recorded growing on hill slopes and valley flats on soils derived from limestone, and on shallow to deep sandy alluvium on rocky river beds and banks.

***Phenology*:** Flowers have been recorded in most months of the year, fruits from September to December with one collection in April.

***Etymology*:** The subspecific epithet is from Latin *vestitus*, meaning 'clothed', in reference to the dense indumentum on the calyx lobes of female flowers of this subspecies.

***Notes*:** This subspecies has long been known by the misapplied name *B. mitchellii* (Bentham 1873, Weber 1986, James and Harden 1990, Jeanes 1999). See 'Notes' under *B. oleifolia.*

Generally *Bertya tasmanica* subsp. *vestita* is remarkably morphologically uniform over the majority of its range from South Australia to western Victoria. The Rohrlach collection from the Eyre Peninsula, South Australia, *Rohrlach* 70 (AD), has a yellowish rather than greyish-white indumentum on its branchlets but it is otherwise typical of *B. tasmanica* subsp. *vestita.* Clintson's specimen from the Grampians, western Victoria, *Clintson* [CANB383031] (CANB), has a sparse stellate indumentum on the ovary and the calyx lobes in female flowers are acute to attenuate which is more characteristic of *B. tasmanica* subsp. *tasmanica.* However, the calyx lobes are sparsely stellate-pubescent, the leaves are robust and the habit is more characteristic of *B. tasmanica* subsp. *vestita.*

In the eastern portions of the range of *B. tasmanica* subsp. *vestita,* there are three variants that warrant further collection and study. These differ in habitat and vestiture characteristics found in plants of the more widespread typical variant to the west.

For comparison purposes, plants from most parts, i.e. the western portions, of the subspecies' distributional range may loosely be identified as belonging to the 'typical variant'. Those from the often disjunct eastern portions may loosely be treated as belonging to the 'golden-haired variant', the 'fine-haired variant' or the 'glabrous ovary variant'.

'Typical variant'

This variant occurs widely in South Australia and western Victoria.

***Representative specimens*: South Australia.** Crown lands WNW of Kimba, Oct 1981, *Alcock* 8869 (AD, CANB); Hundred of Playford, section 282, N of Cowell, Aug 1965, *Alcock* 620 (AD, CANB); 50 miles [c. 80 km] from Kyancutta towards Kimba, on Eyre Highway, Aug 1968, *Canning* (AD, CANB, NSW); c. 29 km N of Pinnaroo on road to Loxton, Oct 1989, *Henderson & Turpin* H3319 (BRI); 3 miles [c. 5 km] N of MacDonald Reserve on Monarto road, Oct 1971, *Melville* 71.677 (AD, K); 2 miles [c. 3 km] W of Murray Bridge, Aug 1952, *Melville & Specht* 408 (MEL, NSW); Mt Rescue National Park, c. 16 km N of Keith, Aug 1968, *Orchard* 1010 (AD); Calperum sandridges, Oct 1980, *Spooner* 7231 (AD); Scorpion Springs Conservation Park, S of Pinnaroo, Oct 1923, *Symon* 8679 (AD, CANB); Mt Shaugh Conservation Park, Oct 1977, *Symon* 10726 (AD, CANB); Chauncey's Line, 10 km SE of Hartley, Sep 1958, *Whibley* 230 (AD). **Victoria.** c. 14 km N along the SA/Vic border track from its intersection with final 3 km track into Red Bluff, Big Desert, Nov 1984, *Albrecht* 1204 (MEL); Murrawong North, Sep 1986, *Beauglehole* ACB83935 (CANB, MEL); 3 miles [c. 5 km] S of Millewa Tank, Sunset Country, Sep 1965, *Filson* 7454A (MEL, NSW); c. 18 km W of Swan Hill, on road to Sealake, Sep 1989, *Henderson & Turpin* H3271 (BRI, CANB); c. 8 km S of Hattah heading towards Ouyen on Calder Highway, Sep 1989, *Henderson & Turpin* H3267 (BRI); S end of Hattah Kulkyne National Park, Bulldozed firebreak 200 m E of Calder Highway, 20 m S of roadside stop, Roadside stop is 27.3 km N of Ouyen, Aug 1996, *Macfarlane* 133 (MEL, NSW); c. 13 miles [21 km] N of Ouyen on the Calder Highway, Aug 1960, *Muir* 1190 (AD, BRI, DNA, MEL, NSW); c. 5.9 miles [9 km] N of Bore Mill, 30.4 miles [c. 49 km] N of Yanac, on Nhill-Murrayville Road, Big Desert, Aug 1959, *Smith* 59/160 (AD, BRI, CANB, MEL).

'Golden-haired variant'

This variant occurs in the Yarrangobilly area on the Southern Tablelands of New South Wales where it is recorded as growing on steep hill slopes and valley flats on soils derived from limestone. The indumentum on most parts is golden-brown and coarser than that in plants typical of *B. tasmanica* subsp. *vestita*. Also, the capsules are less densely hairy than is typical.

***Representative specimens*: New South Wales.** on track to Castle Cove at Yarrangobilly Caves, Oct 1993, *Duncan* (BRI [AQ580505], NSW); Clarke Gorge, Cave Creek, Coolamon Caves, 44 km NNE of Kiandra, Jan 1997, *Jobson et al.* 4616 (BRI, NSW); Cave Creek near the Blue Waterholes (head of Goodradigbee River), Nov 1970, *Rodd* 1532, 1532A (NSW); Cave Creek, ¼ mile [c. 400m] N of the Blue Waterholes (11 miles [c. 18 km] NE of Rules Point), Apr 1969, *Rodd* 806 (NSW); near parking lot opposite Caves House, Yarrangobilly Caves, Nov 1982, *Spate* [CANB463637]

(CANB); Kosciusko National Park, Yarrangobilly Caves, near Glory Arch, Feb 1981, *Taylor & Hadlow* 1328 (CANB); Cooleman Caves area, on Caves Creek, Jun 1965, *Whaite & Whaite* 2864 (NSW); Yarrangobilly Caves, Dec 1948, *Whaite* [NSW194931] (NSW).

'Fine-haired variant'

This variant is recorded mostly from along rivers in eastern Victoria, the Southern Tablelands of New South Wales and the Australian Capital Territory growing on sandy alluvium on rocky river beds and banks, with two records (*Costin*, MEL & NSW) from a treeless basaltic slope. The indumentum on most parts is greyish-white but generally consisting of more slender hairs than those found in the 'typical variant'. The 'fine-haired variant' has generally sparsely hairy and more attenuate calyx lobes in female flowers, and sparsely hairy capsules.

Representative specimens: **Australian Capital Territory.** Pine Island on the Murrumbidgee River, Oct 1971, *Berg* RYB371A (CANB); Angle crossing on Murrumbidgee River, Aug 1988, *Lepschi* 31 (CANB); near Uriarra Crossing, Apr 1954, *McKee* 970 (NSW); Pine Island, Oct 1955, *Moore* 3076 (CANB); Murrumbidgee River, below Kambah Pool, 1 km SSW of Forster Hill, Sep 1989, *Telford* 10822 (BRI, CANB). **New South Wales.** Murrumbidgee and Cotter River junction, Nov 1911, *Cambage* 2980, 2989 (NSW); Cooma, Monaro District, Aug 1948, *Costin* [MEL114081] (MEL); SE of Slack Creek crossing, Cooma - Dry Plain road, Aug 1948, *Costin* [NSW194910] (NSW); 'Murrunga', 8 km S of ACT border, Murrumbidgee River at confluence with Gossoon Creek, Oct 1995, *Crawford* 3165 (CANB, NSW). **Victoria.** Mitta Mitta River, Jan 1854, *Mueller* [MEL114072] (MEL).

'Glabrous ovary variant'

This variant is recorded from scattered localities in the Eastern Highlands of Victoria and the Southern Tablelands of New South Wales. It grows in a habitat similar to that of the 'fine-haired variant'. The 'glabrous ovary variant' has a pale yellow indumentum especially on young shoots, glabrous ovary, sparsely hairy to glabrous calyx lobes and leaves somewhat shorter than those of the 'typical variant'.

***Representative specimens*: New South Wales.** Braidwood District, Jan 1885, *Bauerlen* 369 (MEL); Umaralla River c 3 km SE of Dangelong, c. 20 km SSE of Cooma, Feb 1984, *James & Taylor* 527 (NSW); c. 23 km SSE of Nimmitabel, banks of Bombala River at crossing of New Line Road, Jun 1993, *Makinson & McGillivray* 1211 (BRI, CANB); Umaralla River, downstream from Dangelong, Jun 1976, *Parris* [NSW194934] (NSW); McLaughlin River, 200 m upstream from junction with Jettiba Creek, 7 km directly S of Nimmitabel, Oct 1999, *Taws* 1091 (BRI). **Victoria.** Narracan, Sep 1982, *Merson* [MEL625980] (MEL); Bundarrah River bridge at Angler's Rest (Blue Duck), c. 18 miles [29 km] NW of Omeo, Nov 1962, *Rogers* [MEL114282] (MEL).

28. **Bertya virgata** (Ewart) Halford & R.J.F.Hend. **comb. nov.**

Beyeria virgata Ewart, Proc. Roy. Soc. Victoria 33(new series): 226/7 (1921). **Type:** [Western Australia.] Lake Lefroy, 7 November 1891, *R. Helms* (holo: MEL [MEL114229]; iso: NSW [NSW194995, NSW194996, NSW273281], K).

Bertya dimerostigma var. *cupressoidea* Grüning in A. Engler, Pflanzenr. H.58: 62 (1913); *Bertya cupressoidea* (Grüning) Airy Shaw, Kew Bull. 26(1): 67/8 (1971). **Type:** [Western Australia.] Lake Lefroy, 7 November 1891, *R. Helms* (holo: NSW [NSW194995]; iso: NSW [NSW194996, NSW273281], MEL [MEL114229], K).

Dioecious, much branched shrubs to 1.4 m high, viscid especially on young shoots. Branchlets ± angular, glabrous, with surface papillose under viscid layer. Leaves sessile or shortly petiolate, spirally alternate, appressed; petiole, where present, plano-convex, up to 0.4 mm long, glabrous, smooth; lamina oblong, 1.5–3 mm long, 0.8–1.3 mm wide; adaxial surface green, glabrous, ± smooth; abaxial surface white, densely hairy with sessile stellate (up to 0.1 mm across) and simple (up to 0.5 mm long) hairs; margin strongly recurved to midrib concealing abaxial surface; apex rounded, usually ultimately shortly apiculate and terminated by a gland; base obtuse; midvein obscure adaxially, abaxially raised and rounded, glabrous, smooth; marginal glands sometimes present at base of lamina when 1 each side of midrib, c. 0.1 mm across, sessile. Inflorescences of a single flower, pedunculate, axillary; peduncles up to 0.5 mm long; bracts 4–8, persistent, oblong to linear, 1–2 mm long, 0.3–0.8 mm wide, obtuse or rounded at tip, glabrous. Male flowers sessile; calyx lobes 5, of unknown colour when fresh, elliptic, 2.7–

4.0 mm long, 1–3.7 mm wide, rounded at tip, glabrous; androecium c. 2 mm long, c. 0.5 mm across; stamens c. 26; filaments 0.1–0.2 mm long; anthers 0.8–0.9 mm long. Female flowers sessile; calyx 5-lobed, of unknown colour when fresh; tube up to 0.1 mm long; lobes unequal with inner lobes narrower, erect, ovate or elliptic-ovate, 2.1–2.3 mm long, 0.9–1.5 mm wide, rounded to obtuse at tip, glabrous, with margins entire or minutely fimbriate; petals absent; ovary ovoid, c. 1.5 mm long, 0.6–1.3 mm across, 3-locular, glabrous; style with glabrous column 0.2–0.3 mm long and 3 spreading limbs; limbs of unknown colour when fresh, c. 1 mm long, c. 0.3 mm wide, deeply 2-lobed; lobes 0.6–1 mm long, 0.1–0.2 mm wide. Capsule ellipsoid, 3.9–4.5 mm long, 3.2–3.7 mm across, glabrous, 1 - seeded; persistent calyx lobes ≤ half the capsule length. Seed ellipsoid, c. 3.3 mm long, c. 2.5 mm wide, c. 2.4 mm across, light brown; caruncle not seen.

***Selected specimens (from 11 examined)*: Western Australia.** 84 km from Norseman along Eyre Highway to Balladonia, Feb 1970, *Barnsley* 1069 (CANB); 76 km E of Norseman on Eyre Highway, Aug 1995, *Cranfield* 10044a (NSW); c. 75 km ENE of Norseman, Sep 1973, *Donner* 4652 (PERTH); Lake Lefroy, Nov 1891, *Helms* (MEL, NSW); 46 miles [c. 74 km] E of Norseman, Oct 1963, *Jefferies* 631016 (K, PERTH); [without locality,] May 1964, *Jefferies* 640505 (PERTH); 22 km E of Sinclair Soak, c. 70 km NE of Norseman, Sep 1980, *Newbey* 7510 (CANB, PERTH); 30 km E of Sinclair Soak, c. 90 km NE of Norseman, Aug 1980, *Newbey* 7079 (PERTH).

***Distribution and habitat*:** *Bertya virgata* is confined to the south-west of Western Australia between Coolgardie and Norseman (Map 33). It is recorded as growing in open mallee or low open woodland communities on well-drained aeolian sandy or pebbly brown sandy clay soils on sand dunes.

***Phenology*:** Flowers have been recorded in May, August and September, fruits in August and September.

Excluded names

Bertya andrewsii W.Fitzg., J. Western Australia Nat. Hist. Soc. 2(2): 31 (1905) = ***Ricinocarpos stylosus*** Diels

Bertya gummifera var. *psiloclada* Müll.Arg., Flora 47(30): 471 (1864) = ***Ricinocarpos psiloclada*** (Müll.Arg.) Benth.

Bertya psiloclada (Müll.Arg.) Baill., Adansonia 6: 299 (1866), *nom. inval.* = ***Ricinocarpos psiloclada*** (Müll.Arg.) Benth.

Bertya quadrisepala F.Muell., Fragm. 10: 52 (1876) = ***Ricinocarpos muricatus*** Müll.Arg.

Acknowledgements

We would like to thank Gordon Guymer, Director of BRI, for making working space and facilities at BRI available for the first author, the directors and curators of AD, CANB, DNA, HO, K, MEL, NE, NSW and PERTH for the loan of their holdings for study at BRI. The following persons provided assistance and they are thanked sincerely for their efforts; Alex Chapman and Bob Chinnock for searching for types on our behalf at CGE and BM while acting as Australian Botanical Liaison Officer at K, Will Smith (BRI) for the illustrations, Gerry Turpin, Paul Robins and Andrew Franks (all BRI) during fieldwork undertaken by the second author and Peter Bostock (BRI) for preparing the maps. Associated fieldwork from 1988 to 1992 by the second author and salary support in 1999 and 2000 for the first author was funded by grants from the Australian Biological Resources Study (ABRS), Environment Australia, which are gratefully acknowledged.

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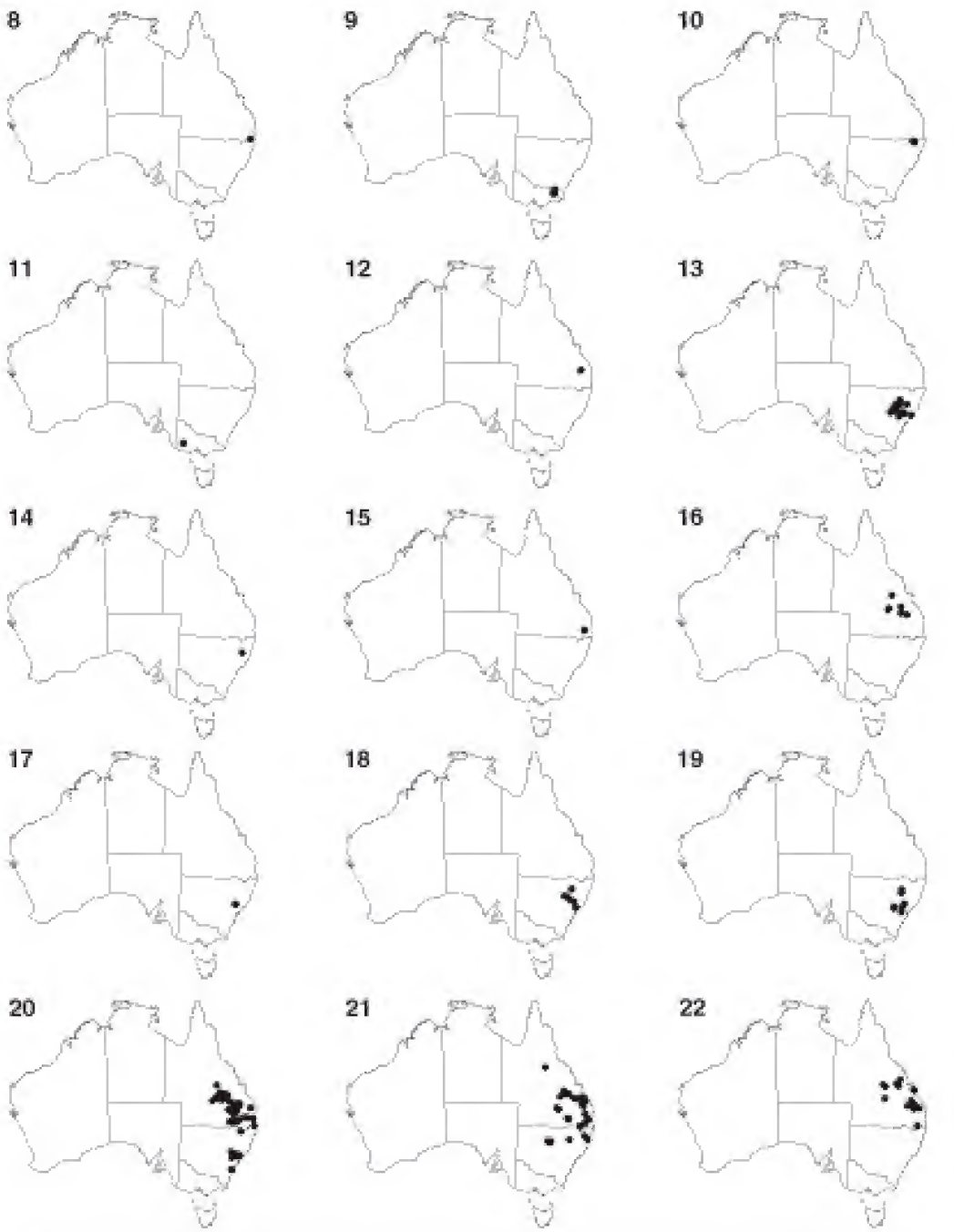
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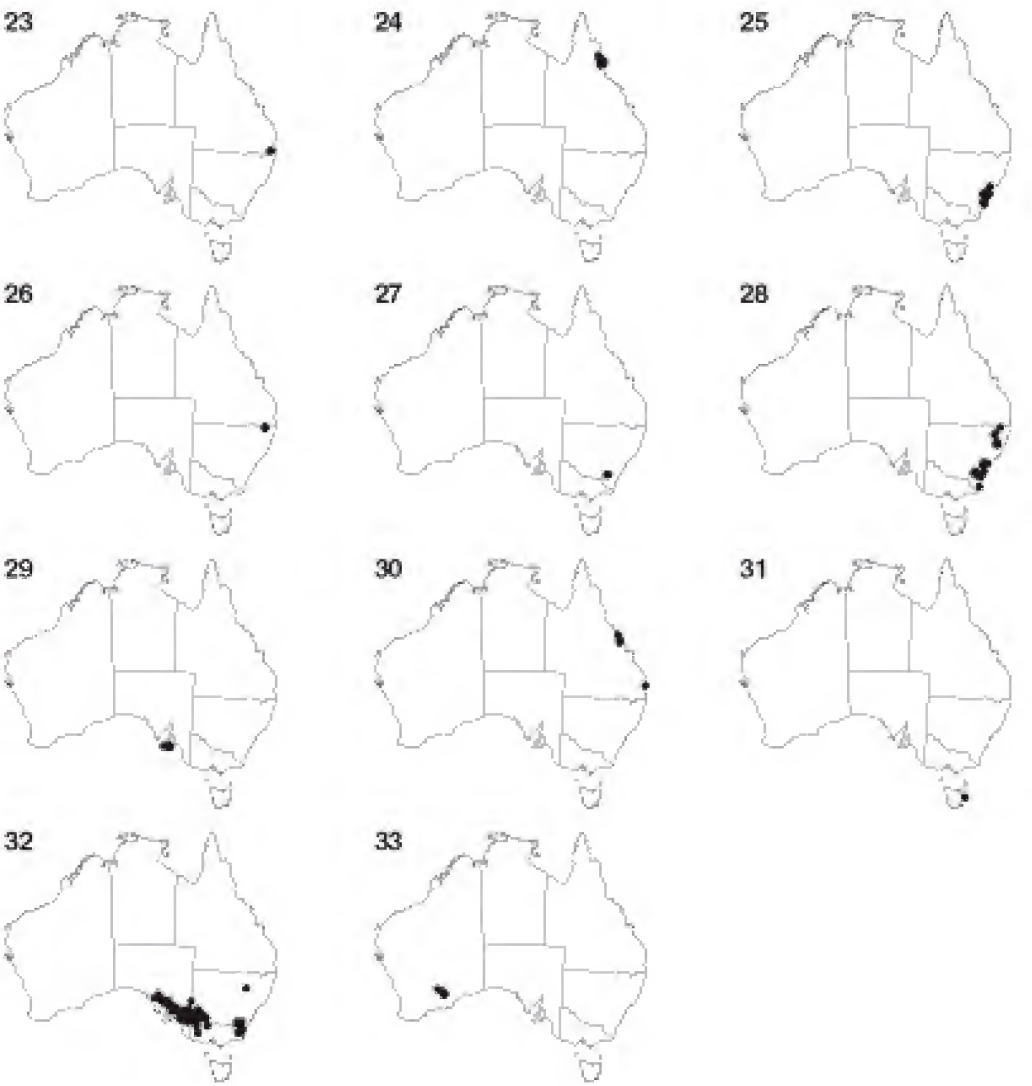
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Maps 2–7. Distribution of *Bertya* taxa. **2.** *Bertya brownii* **3.** *Bertya calycina* **4.** *Bertya cunninghamii* subsp. *cunninghamii* **5.** *Bertya cunninghamii* subsp. *pubiramula* **6.** *Bertya cunninghamii* subsp. *rupicola* **7.** *Bertya dimerostigma*



Maps 8–22. Distribution of *Bertya* taxa. **8.** *Bertya ernestiana* **9.** *Bertya findlayi* **10.** *Bertya glandulosa* **11.** *Bertya grampiana* **12.** *Bertya granitica* **13.** *Bertya gummifera* **14.** *Bertya ingramii* **15.** *Bertya lapicola* subsp. *lapicola* **16.** *Bertya lapicola* subsp. *brevifolia* **17.** *Bertya linearifolia* **18.** *Bertya mollissima* **19.** *Bertya oblonga* **20.** *Bertya oleifolia* **21.** *Bertya opponens* **22.** *Bertya pedicellata*



Maps 23–33. Distribution of *Bertya* taxa. **23.** *Bertya pinifolia* **24.** *Bertya polystigma* **25.** *Bertya pomaderroides* **26.** *Bertya recurvata* **27.** *Bertya riparia* **28.** *Bertya rosmarinifolia* **29.** *Bertya rotundifolia* **30.** *Bertya sharpeana* **31.** *Bertya tasmanica* subsp. *tasmanica.***32.** *Bertya tasmanica* subsp. *vestita* **33.** *Bertya virgata*

Index to Scientific Names

Names in bold type are accepted names and those in light are synonyms etc. The numbers refer to the number of the species accepted in the above taxonomic treatment. 'Excl.' refers to a name listed under Excluded names which applies to a taxon generically distinct from *Bertya*.

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Bertya brownii S.Moore 1
Bertya calycina Halford & R.J.F.Hend. 2
Bertya cunninghamii Planch. 3
Bertya cunninghamii Planch. subsp. ***cunninghamii*** 3a
Bertya cunninghamii subsp. ***pubiramula*** Halford & R.J.F.Hend. 3b
Bertya cunninghamii subsp. ***rupicola*** Halford & R.J.F.Hend. 3c
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Bertya glandulosa Grüning 7
Bertya grampiana Halford & R.J.F.Hend. 8
Bertya granitica Halford & R.J.F.Hend. 9
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Bertya gummifera var. *genuina* Mull.Arg. 10
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Bertya lapicola Halford & R.J.F.Hend. subsp. ***lapicola*** 12a
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New prostrate species in *Solanum* subg. *Leptostemonum* (Dunal) Bitter (Solanaceae) from eastern Australia

A.R. Bean

Summary

Bean, A.R. (2002). New prostrate species in *Solanum* subg. *Leptostemonum* (Dunal) Bitter (Solanaceae) from eastern Australia. *Austrobaileya* 6: 247–252. Two new prostrate *Solanum* species (*S. serpens* and *S. acanthodapis*) are described from subtropical notophyll rainforest near the Queensland-New South Wales border in eastern Australia. Both are stoloniferous, with long trailing stems that frequently root at the nodes. In *Solanum* subg. *Leptostemonum,* this growth habit is thought to be confined to these species and one other taxon.

Keywords: *Solanum, Solanum* subg. *Leptostemonum*, Solanaceae, *Solanum serpens*, *Solanum acanthodapis*, Queensland, New South Wales, taxonomy, prostrate, stoloniferous, new species, Australia.

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Introduction

Solanum subg. *Leptostemonum* has several hundred representatives throughout the warmer parts of the world. Members are distinguished by the stellate indumentum, prickly herbage and attenuate anthers (Whalen 1984).

The two new species, together with a third taxon, *Solanum discolor* var. *procumbens* C.T.White (still under study), are apparently unique in the subgenus because of their prostrate habit, with the stems rooting at the nodes at frequent intervals. Numerous other Australian species are small annual herbs that can spread by rhizome, while others are procumbent with stems trailing from a perennial rootstock (e.g. *S. echinatum* R.Br.), but such stems never form roots. In other countries, species are reported to vary from annual herbs to trees (including two Colombian species which attain 20 metres in height; Whalen 1984), but I can find no reference to prostrate stoloniferous members of *Solanum* subg. *Leptostemonum* in any Floras I have examined.

As the prostrate habit is difficult to detect from a herbarium sheet, and because habit is rather variable in some species of *Solanum*, the taxa treated in this paper have received inadequate attention from botanists in the past.

Bentham (1868) mentioned an unusually broad-leaved and prickly specimen of *S. stelligerum* Sm. from "Cape Byron", which can probably be attributed to *S. serpens*. White (1944) described *S. stelligerum* var. *procumbens*, for plants he collected from southern Queensland. Symon (1981) reduced this to *S. stelligerum*.

Field studies have shown that *S. stelligerum* var. *procumbens* C.T.White is not closely related to *S. stelligerum*, and is described here at species level, as *S. serpens*. *Solanum serpens* differs from *S. stelligerum* by its broader leaves and stellate hairs with a longer central ray, its andromonoecious inflorescences, and its much larger fruits, yellow-green at maturity and with a much thicker pericarp.

The other prostrate species (named here as *S. acanthodapis*) occurs around Lismore in northern New South Wales.

Solanum serpens and *S. acanthodapis* are both known from several small disjunct populations, widely separated by extensive clearing for grazing, agriculture and

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urbanisation. They both exhibit quite a high level of morphological variation between populations (especially in the density of indumentum of the lower leaf surface), although remain remarkably uniform within each population. This variation makes delimitation of taxa difficult in some areas. They are endemic to the area formerly covered by the Tweed Shield Volcano, centred on the plutonic complex of Mount Warning. Lava flows from this extended as far north as Mt Tamborine and southwards beyond Lismore (Ewart *et al.* 1987).

Taxonomy

Key to prostrate rainforest *Solanum* taxa in eastern Australia

1. Stellate hairs on leaves and branchlets lacking a central ray **S. discolor** var. **procumbens** C.T.White
 Stellate hairs on leaves and branchlets with a clearly discernible central ray 2

2. Leaves usually lobed; prickles numerous on both leaf surfaces; ovary and style without stellate hairs; stellate hairs of lower leaf surface with central ray 0.2–1 times as long as laterals **S. acanthodapis**
 Leaves entire; prickles absent from lower leaf surface, rare on upper leaf surface; ovary and style with stellate hairs; stellate hairs of lower leaf surface with central ray 3–5 times as long as laterals **S. serpens**

Solanum serpens A.R.Bean **sp. nov.** Frutex prostrates stolonifer; folia integra, aculei sparsi vel nulli in laminae folii, pili stellati radiis centralibus longissimis praediti; inflorescentiae flores bisexualesque masculos ferentes; ovarium pilis stellais et glandibus stipitatis praeditum; fructus maturitate 14-16 mm diam., chlorini. **Typus:** Queensland. MORETON DISTRICT: Cainbable Creek track, Lamington National Park, 11 December 1999, *A.R. Bean* 15903 (holo: BRI (1 sheet + spirit); iso: CANB, MEL, NSW).

S. stelligerum var. *procumbens* C.T.White, *Proc. Roy. Soc. Queensland* 55: 72 (1944). **Type:** Queensland. MORETON DISTRICT: Lamington National Park, 27 November 1942, *C.T.White* 11889 (holo: BRI, 2 sheets).

Solanum sp. (Lamington W.J. McDonald 6176), in Henderson (2002).

Prostrate shrub with long runners, rooting at the nodes, with sporadic erect shoots to 30 cm high. Fertile branchlets terete, grey to rusty, tomentose, with dense (branchlet visible) stellate hairs, densely armed with prickles (15–35 per dm of branchlet), each 3–6 mm long, glabrous; stellate hairs sessile, 0.25–0.35 mm diameter, lateral rays porrect, 8, central ray 4–9 times as long as laterals. Adult leaves broadly-ovate to elliptical, entire, 5.5–10 cm long, 2.6–4.0 cm wide, 1.4–2.9 times longer than broad, apex acute or obtuse, often basally dimidiate, oblique part 0–3 mm long, obliqueness index 0–4%. Petioles 6–15 mm long, 10–19% length of lamina, prickles present. Upper leaf surface green, prickles often absent, sometimes present on midrib and secondary veins; stellate hairs distributed throughout lamina at least on developing leaves, often confined to major veins on fully expanded leaves, 0.3–0.5 mm diameter, sessile, sparse (>0.5 mm apart), lateral rays porrect, 7–8, central ray 3–6 times as long as laterals. Lower leaf surface white to rusty or greenish, prickles absent; stellate hairs very dense (obscuring leaf surface) or dense (leaf surface not obscured), 0.3–0.4 mm across, sessile, lateral rays porrect, 7–8, central ray of most hairs 3–5 times as long as laterals, some with central ray much shorter. Inflorescences cymose, pseudo-umbellate or with short axis, 1–4 flowered, some flowers functionally male, prickles present or absent on pedicels. Pedicels

11–28 mm long at anthesis. Flowers 5-merous. Calyx densely stellate-hairy, hairs 0.3–0.4 mm diameter, transparent, lateral rays 7–8, central ray 2–5 times as long as laterals. Prickles absent from calyx. Hypanthium campanulate, 1.5–2.5 mm long at anthesis; lobes attenuate, 4–7 mm long at anthesis. Corolla purple, 20–25 mm diameter, lobes 6–10 mm long. Anthers 3.5–5.5 mm long. Filaments 0.6–1 mm long, glabrous. Ovary with stipitate glandular and stellate hairs on distal half, stellate hairs c. 0.5 mm diameter, central ray 2–3 times as long as laterals. Functional style 7.5–8 mm long, erect, with stellate hairs on proximal half, 0.5–0.7 mm diameter, lateral rays 8–9, central ray 1–2 times as long as laterals; stigma entire. Mature fruits 1–2 per inflorescence, globular, 14–16 mm diameter, yellow-green, glabrous, septum absent with placenta confined to central area of fruit; pericarp 0.6–0.8 mm thick when fresh. Pedicels 20–32 mm long. Seeds 3.5–4.0 mm long, pale yellow. Fig. 1.

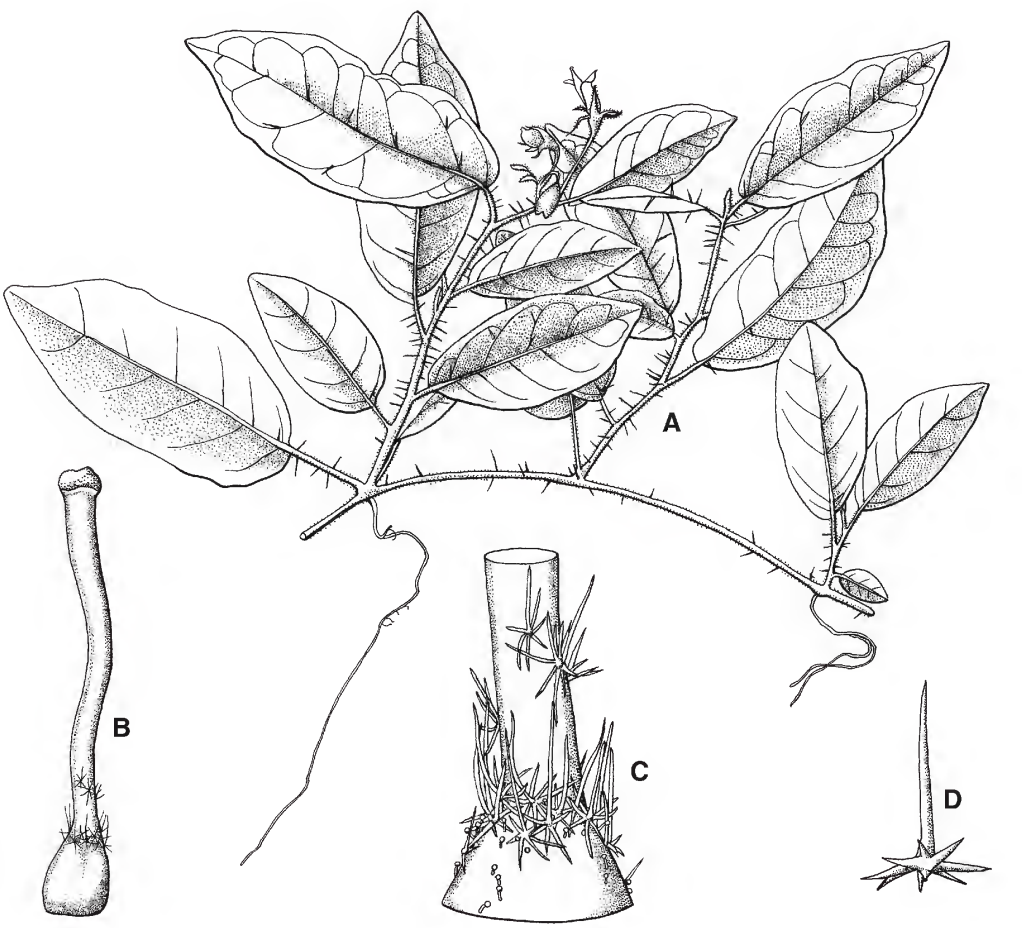
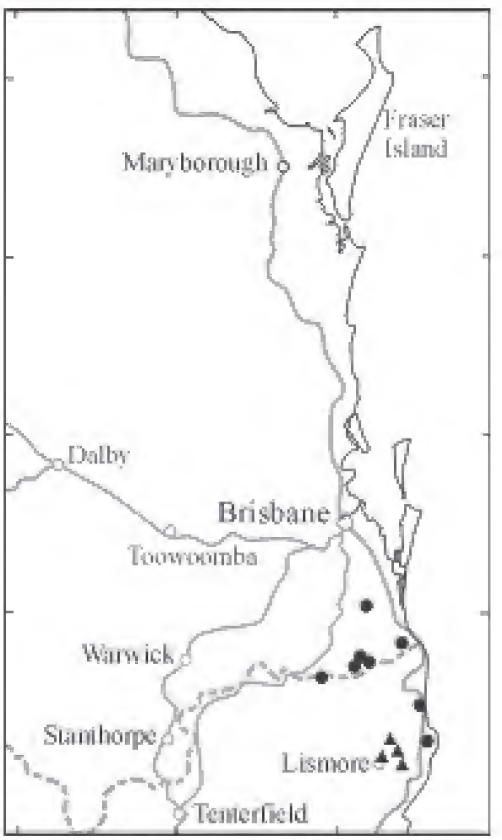


Fig. 1. ***Solanum serpens.*** A. flowering twigs arising from stolon × 0.8; B. style and ovary × 6; C. upper part of ovary and base of style showing stellate hairs and stipitate glandular hairs × 20; D. a stellate hair from the lower leaf surface × 60. All from *Bean* 15903 (BRI).

Specimens examined: **Queensland**. MORETON DISTRICT: above Cainbable Creek Falls, Lamington N.P., Jan 2000, *Bean* 15961 (BRI); Romeo Lahey Monument, Lamington N.P., Mar 2000, *Bean* 16133 (BRI, NSW); track to Pat's Bluff, Lamington N.P., Mar 2001, *Bean* 17384 (BRI); Nicholls scrub, c. 6 km SW of Currumbin, Mar 2001, *Bean* 17398 (BRI); Cainbable Ck track, Lamington N.P., Nov 1995, *McDonald* 6176 (BRI); Tamborine Mtn, Easter 1888, *Simmonds* 346 (BRI); Numinbah, Apr 1935, *White* 10232 (BRI); Currumbin scrubs, Sep 1912, *White s.n.* (BRI); Head of Little Nerang R., Jan 1916, *White s.n.* (BRI). **New South Wales.** NORTH COAST: Brunswick Heads Nature Reserve, Oct 2000, *Bean* 16929 (BRI); Brunswick Heads, Jul 1969, *Coveny* 1331 *et al.* (NSW); Three Mile Scrub, near Byron Bay, Nov 1898, *Forsyth* (NSW); Levers Plateau, Apr 1972, *Henderson* H1299 (BRI); Byron Bay, *Maiden & Boorman*, Nov 1903 (NSW).

Distribution and habitat: Distributed sporadically along the McPherson Range, as far west as Levers Plateau, and north to Mt Tamborine, and on lowland sites from Currumbin (Qld) to Byron Bay (N.S.W.) (Map 1). It grows in complex notophyll rainforest, sometimes with Hoop Pine, on fertile loams or clay-loams.



Map 1. Distribution of *Solanum serpens* ● and *S. acanthodapis* ▲.

Phenology: Flowers October to April; fruits March-April.

Affinities: Most closely related to *S. acanthodapis* (see discussion under that species). While it does not appear to be closely related to any other species, it has some affinity to a fairly large group of species that includes *S. furfuraceum* R.Br, *S. tetrathecum* F. Muell. and *S. ellipticum* R.Br.

Notes: The colour and density of indumentum on the lower leaf surface is uniform within populations but can vary between localities. *S. serpens* at the type locality has an extremely dense white tomentum; whereas in specimens from Nicholls Scrub and Byron Bay, the tomentum is rusty and less dense.

Conservation status: Known from about a dozen subpopulations, several of which are on protected land. No conservation status is recommended at present.

Etymology: The specific epithet is from the Latin *serpens*, meaning creeping or snake-like. This refers to the long trailing stems.

Solanum acanthodapis A.R.Bean **sp. nov.**
Frutex prostratus laete viridis stolonifer; folia lobata; aculei numerosis in lamina; pili stellati radiis brevibus centralibus praediti, inflorescentiae flores bisexualesque masculos ferentes; ovarium glandibus stipitatis praeditum sed pilis stellatis carens; fructus maturitate 15–18 mm diam., chlorini. **Typus:** New South Wales. NORTH COAST: Big Scrub flora reserve, c. 20 km N of Lismore, 2 December 2000, *A.R.Bean* 17075 (holo: BRI (1 sheet + spirit); iso: AD, K, L, MEL, NSW).

Prostrate shrub with long runners, rooting at the nodes, with sporadic erect shoots to 30 cm high. Fertile branchlets terete or ridged, pale brown, tomentose, with moderate to dense (branchlet visible) stellate hairs, densely armed with prickles (25–65 per dm of branchlet), each 3–7 mm long, glabrous; stellate hairs sessile, 0.2–0.35 mm diameter, lateral rays porrect, 7 or 8, central ray 0.5–1.5 times as long as laterals. Adult leaves ovate to elliptical in outline, usually with 2–4 pairs of acute lobes,

rarely entire; lobing index 1–1.4; lamina 5.5–9.5 cm long, 2.8–4.5 cm wide, 1.6–2.3 times longer than broad, apex acute, basally dimidiate, oblique part 0–2 mm long, obliqueness index 0–3%. Petioles 10–17 mm long, 14–29% length of lamina, prickles present. Upper leaf surface dark green, prickles numerous (>30) on midrib and secondary veins; stellate hairs confined to major veins even on developing leaves, 0.2–0.3 mm diameter, sessile, sparse, lateral rays porrect, 6–8, central ray 0.5–1.2 times as long as laterals. Lower leaf surface pale green to pale yellow, prickles more than 10 on midrib and secondary veins; stellate hairs sparse to very dense, 0.25–0.35 mm across, sessile, lateral rays porrect, 7 or 8, central rays uniform in length, 0.2–0.8 times as long as laterals. Inflorescences cymose, pseudo-umbellate or with short axis, 2–8 flowered, some flowers functionally male, prickles present on pedicels. Pedicels 9–20 mm long at anthesis. Flowers 5-merous. Calyx moderately stellate-hairy, hairs 0.2–0.3 mm diameter, transparent to purplish, lateral rays 7 or 8, central ray 0.5–1 times as long as laterals. Prickles absent from calyx or a few short (0.5–1 mm long) prickles present. Hypanthium campanulate, 2–3 mm long at anthesis; lobes attenuate, 1.5–2.5 mm long at anthesis. Corolla mauve to purple, 15–20 mm diameter; lobes 5–7 mm long. Anthers 4.0–5.0 mm long. Filaments 0.6–1 mm long, glabrous. Ovary with stipitate glandular hairs on distal half. Functional style 6–7.5 mm long, erect, with stipitate glandular hairs at base; stigma entire. Mature fruits 1 per inflorescence, globular to ellipsoidal, 15–18 mm diameter, yellow-green, glabrous, septum incomplete with placenta confined to central area of fruit; pericarp c. 0.8 mm thick when fresh. Pedicels 21–24 mm long. Seeds 3.5–4.0 mm long, pale yellow. Fig. 2.

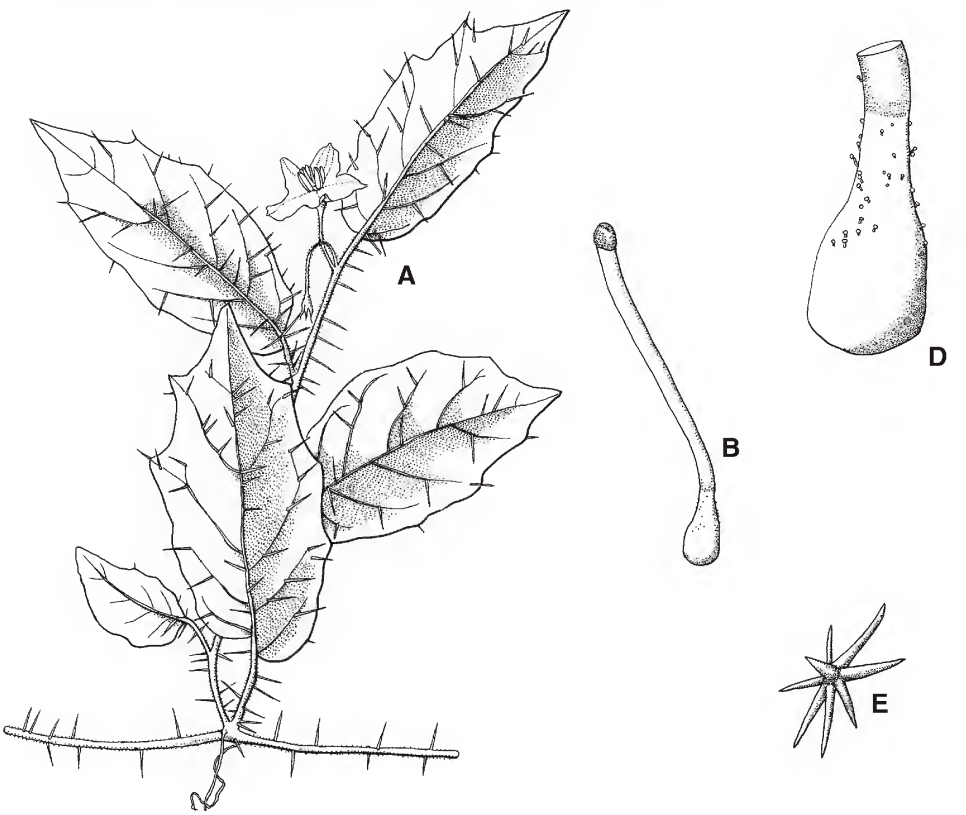


Fig. 2. ***Solanum acanthodapis.*** A. erect flowering shoot arising from stolon × 0.8; B. style and ovary × 6; C. ovary and base of style showing stipitate glandular hairs × 20; D. a stellate hair from the lower leaf surface × 60. All from *Bean* 17075 (BRI).

Specimens examined: **New South Wales.** NORTH COAST: Victoria Park Nature Reserve, c. 8 km S of Alstonville, Apr 2001, *Bean* 17564 (AD, BRI, MEL, NSW); Victoria Park, 4 miles [6km] SSW of Alstonville, Aug 1969, *Clark* 1260 *et al.* (BRI, NSW); Big Scrub Flora Reserve, Apr 2001, *Bean* 17561 (BRI, NSW); Rotary Park, Lismore, Dec 2000, *Bean* 17081 (BRI); Booyong Flora Reserve, ENE of Lismore, Dec 2000, *Bean* 17083 (BRI).

Distribution and habitat: Of restricted distribution in far north-eastern New South Wales, from Whian Whian S.F. in the north to near Alstonville in the south (Map 1). It grows in low-altitude complex notophyll rainforest usually on basaltic clay-loams, but also on meta-sediments.

Phenology: Flowers August-February; fruits March-April.

Affinities: *S. acanthodapis* differs from *S. serpens* by: stellate hairs (on all parts) with short central rays (*versus* very long central ray for *serpens*); upper leaf surface (excluding veins) glabrous even on developing leaves; lateral veins somewhat raised on upper leaf surface; ovary glabrous or with stipitate glandular hairs only (*versus* stipitate glandular hairs & stellate hairs for *S. serpens*).

Conservation Status: *S. acanthodapis* is known from only four locations, with a total population certainly less than 10,000 individuals (and probably less than 1,000 individuals). Applying the IUCN Criteria (Anon. 2001), a conservation status of "Vulnerable" is recommended (Criterion C (2a)). It is threatened by weeds, clearing of its habitat and destruction by humans.

Etymology: From the Greek *acanthos-* prickly and *dapis-* a carpet or rug, alluding to the habit of the plant. Well-developed plants resemble a prickly green carpet.

Note: A collection from the property of Mr. B. Walker, southern outskirts of Nimbin (Bean 16948 (BRI, MEL, NSW)) is morphologically intermediate between *S. serpens* and *S. acanthodapis*.

Acknowledgements

I am grateful to a number of people for their assistance in the field, or for pointing me towards prostrate *Solanum* populations; Bill McDonald, Glenn Leiper, Lance Fitzgerald, Robert Kooyman and Barry Walker. Thanks to Will Smith for the illustrations and Peter Bostock for the Latin diagnoses.

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Four new species of *Goodenia* Smith (Goodeniaceae) from Queensland

A.E.Holland & T.P.Boyle

Summary

Holland, A.E. & Boyle T.P. (2002). Four new species of *Goodenia* Smith (Goodeniaceae) from Queensland. *Austrobaileya* 6 (2): 253–265. Four new species are described for Queensland: two new species from northern Queensland, *G. splendida* and *G. debilis*, and two from the south-west of the state, *G. atriplexifolia* and *G. expansa*. A central Queensland species, *G. rosulata* Domin, is also reinstated. Notes on affinities and conservation status are included. A key to the species occurring in Queensland is provided.

Keywords: *Goodenia* - Queensland, *Goodenia splendida*, *Goodenia debilis*, *Goodenia atriplexifolia*, *Goodenia expansa*, *Goodenia rosulata*

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Introduction

Goodenia Smith is a genus of approx. 200 species, mostly endemic to Australia. Carolin described a number of new species and varieties for Queensland in 1990 and provided a key to all of the Australian species (Carolin 1992). Since then, several new taxa have been identified as part of an overall review of the approximately 57 species occurring in Queensland. All of these taxa were first collected prior to 1990 but further collections have enabled elucidation of characters and determination of status and relationships. The key was written in response to a need for a State based identification tool.

Species of *Goodenia* are distinguished from the other genera of Goodeniaceae by the usually bilabiate flowers (2 long adaxial and 3 shorter abaxial corolla lobes), free stamens, ovary incompletely 2-locular with more than 2 ovules, the (usually) 2-valved dry, dehiscent capsule, and the seeds which are flattened and often winged. The subgenus *Monochila* (G.Don) Carolin does not occur in Queensland but all of the 4 sections of the subgen. *Goodenia* are represented (Carolin 1992).

Materials and methods

This review was based on the examination of herbarium specimens and reconstituted floral material from BRI. Floral measurements were mainly based on material reconstituted in boiling water. The remainder was measured from dried material. Distributions of the new taxa are given in the maps. Distributions by pastoral district of the other Queensland taxa are given in Henderson (2002). The maps were generated from the herbarium label database HERBRECS.

The key was written using field characters where possible, but a hand lens is needed for some characters. It is preferable to have flowering and fruiting material present when using the key.

Terminology

The terms used follow Carolin (1992). The term "bract" is used for cauline "leaves" which subtend flowers. The bracts are often different in size and/or shape from the basal leaves. Bracteoles occur on the flower stalk and mark the top of the peduncle and bottom of the pedicel. If no bracteoles are present, the whole stalk is taken to be the pedicel. For cymes and thyrses the bracts are only the basal pair of appendages. The sepals of most Queensland species are adnate to the ovary nearly to the ovary apex. Only the free part is measured. Terms for corolla parts include "abaxial lobes" which are the three shorter or fan lobes and "adaxial lobes" which are the two longer lobes. These are sometimes auriculate and surround the indusium. The auricle is usually clearly marked and of different tissue from the wings, but in some cases (see below) it is indistinct and merged with the wing which, itself, is enlarged in the middle. Corolla lobe

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measurements do not include the wings (these are given separately).

1. Goodenia splendida A.E.Holland & T.P.Boyle, **sp. nov.** *G. ramelii* affinis sed foliis angustioibus, sepalis et pedicellis longioribus, ovalis paucioribus et seminibus longioribus differens. **Typus:** Queensland. South Kennedy District: About 22.5 km NNW of Yarrowmere Station, on Great Dividing Range, 15 October 1983, *R.J.Henderson* H2844, *G.P.Guymer & H. Dillewaard* (holo: BRI (2 sheets); iso: SYD, US, MEL, AD).

Goodenia sp. (Yarrowmere, R.J.Henderson+ H2844)

Erect, densely tufted perennial herb to 50 cm high, with a short woody stem and thickened taproot. All parts viscid, with multicellular glandular hairs 0.1–0.6 mm long. Leaves mostly basal, narrowed into a petiole to 3 cm long, or sessile; lamina oblanceolate to lanceolate, 4–15 cm long, 5–20 mm wide, L:W ratio 5–12 (–17):1, apex acute, base tapered, margins entire or denticulate, both surfaces glandular hairy, or nearly glabrous; lowest leaves often 3-veined. Inflorescence a raceme or thyrse to 25 cm long (at least ½ of the plant); bracts oblanceolate, lanceolate or linear, 10–30 mm long, 0.5–3 mm wide, acute, entire; peduncles 5–25 mm long; bracteoles similar to bracts, 3–17 mm long; pedicel 3–8 mm long; articulated just below ovary. Sepals subequal, adnate to ovary almost to apex, free part subequal, linear to lanceolate, 3–6 mm long, 0.5–1.2 mm wide, bluntly acute. Corolla 12–20 mm long, blue or purple; outer surface with a mixture of glandular and strigose hairs; inner surface with a few long hairs on margins and in throat, enations prominent; anterior pouch prominent, 3–6 mm long, *c.* 1 mm wide, slightly shorter than ovary. Abaxial corolla lobes 3.5–7 mm long, 1.2–2.0 mm wide, wings (2.5–) 5–7 mm long, 1.5–2 mm wide, entire. Adaxial corolla lobes free almost to base, 7–12 mm long; 1.2–2.0 mm wide; auricle indistinct, merged with wing 6–9 mm long, 1.5–2 mm wide; opposite wing 3–6 mm long, 1.5–2 mm wide. Stamen filaments 4–5 mm long; anthers 1.5–2.5 mm long. Ovary 4–9 mm long, with longitudinal ribs, rounded or cuneate at base, densely glandular hairy; septum ¾ of ovary length; ovules 20–34. Style 9–11 mm long, villous; indusium square to oblong, 1.9–2.4 mm long, 1.6–2.2 mm wide, with scattered long hairs, pale brown; upper lip slightly convex with bristles to 0.3 mm long; lower lip shorter, with bristles *c.* 1 mm long; bristles tinged purple. Fruit ellipsoid, 8–11 mm long, 3–4 mm wide, dehiscing longitudinally almost to base. Seed elliptic, 1.9–2.4 mm long, 1.3–2.2 mm wide, colliculate at maturity, brown; wings absent or very narrow. Fig. 1. A–D.

***Additional specimens examined*: Queensland.** Mitchell District: Poison Valley, Torrens Creek, White Mountains National Park, Apr 2000, *McDonald* KRM452 (BRI); White Mountains National Park, (Site 74), Apr 2000, *Thompson* HUGT38 & *Thomas* (BRI). North Kennedy District: North Branch Creek, White Mountains National Park, Apr 1992, *Bean* 4314 (BRI, NSW, MEL); Burra Range, N of Burra Microwave Tower, May 1991, *Cumming* 11020 (BRI, DNA, PERTH); 19 km N of Burra Microwave Tower towards Poison Valley, W of Pentland, without date, *Cumming* 9583 (BRI); 16 km N of Burra Range Microwave, Jul 1984, *Jackes* s.n. (BRI). South Kennedy District: 27.5 km W of St Anns homestead (Site10/6–7), Jun 1992, *Thompson* BUC816 & *Sharpe* (AD, BRI, DNA, NSW, MEL, PERTH, K); Darkies Range, *c.* 17 km SW of Lake Buchanan, Mar 1998, *Thompson* BUC2114 & *Turpin* (AD, BRI, MO).

***Distribution and habitat*:** North Queensland, from the White Mountains National Park and as far south as Lake Buchanan. Occurs in *Eucalyptus* and *Corymbia* woodland and open *Melaleuca* shrublands, in sandy or gravelly soil over sandstone. Common after fire. Map 1.

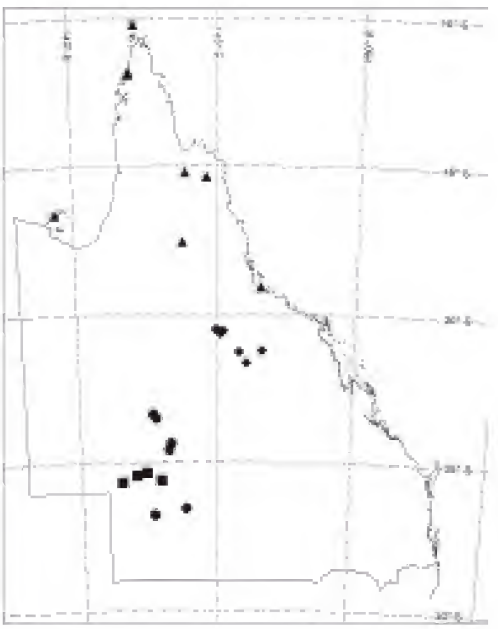
***Phenology*:** Flowers March to October, possibly at other times.

***Affinities*:** This new species belongs in *Goodenia* sect. *Caeruleae* (Benth.) Carolin, subsect. *Scaevolina* Carolin (Carolin 1992). *Goodenia splendida* is most closely related to *Goodenia ramelii* F.Muell. which occurs in the north west of the state. *Goodenia splendida* is a smaller plant and has narrower leaves, longer sepals and pedicels, fewer ovules and longer seeds. *Goodenia ramelii* grows to 1 m high, with leaves 2–4.5 cm wide, pedicel to 4 mm long, sepals to 2 mm long and 40–50 ovules.

Carolin saw only one collection of this species (the type material of *G. splendida*) and included it in his description of *G. scaevolina* F.Muell. He comments "the single collection



Fig. 1. ***Goodenia splendida.*** A, raceme; B, flower; C, indusium; D, seed. ***Goodenia debilis*** E. raceme; F, flower; G, seed. A from *Bean* 4314; B–D from *Cumming* 11020 (BRI); E & G from *Forster* PIF22614 (BRI); F from *Clarkson* 7783 (BRI).



Map 1. Distribution of *Goodenia splendida* ◆, *Goodenia debilis*▲, *Goodenia atriplexifolia*● and *Goodenia expansa*■.

from the highlands of northern Qld resembles the specimens from Victoria R. area but has a very prominent pouch." *Goodenia splendida* differs from *G. scaevolina* in the narrow, mostly basal leaves, shorter sepals and smaller corolla. *G. scaevolina* is a subshrub to 80 cm and has cauline leaves 20–30 mm wide, sepals 5–10 mm long and corolla 20–25 mm long. It is not known to occur in Queensland.

***Etymology*:** This name refers to the showy foliage and flowers.

***Conservation*:** Conserved in the White Mountains National Park and known to be common in the areas from which it has been collected. Not considered to be rare or threatened at present.

2. Goodenia debilis A.E.Holland & T.P.Boyle, **sp. nov.** *G. armstrongianae* affinis sed foliis integris longioribus angustioribusque, corollas brevioribus, ovalis paucioribus et testa alveolatus differens. **Typus**: Queensland. Cook District: Bulleringa National Park, 80 km NE of Mt Surprise, Red River track past Donkey Spring, *P.I.Forster* PIF22614 & *R.Booth* (holo: BRI; iso: DNA, NSW)

Goodenia sp. (Welcome Creek, A.R.Bean 1936)

Ascending or weakly erect annual herb up to 40 cm high, with one to several thin stems branched from base. All parts strigose with appressed white hairs 0.2–0.6 mm long or nearly glabrous. Leaves cauline and sessile; lamina erect or ascending and slightly decurrent; lamina linear-lanceolate, 1–5 cm long, 0.5–3 mm wide, L:W ratio (leaves and bracts) 12–32:1, apex acute, margins entire, recurved or flat, both surfaces strigose at least on margins and midrib. Inflorescence a leafy raceme to 20 cm long (more than ½ of the plant); bracts leaf-like; pedicel divaricate, thread-like, 11–22 mm long; articulated just below ovary; bracteoles absent. Sepals adnate to ovary almost to apex, free part subequal, linear, 1.1–1.8 mm long, *c.* 1 mm wide. Corolla 4–6 mm long, cream or yellow, with brownish markings; outer surface strigose; inner surface ±glabrous, enations absent; anterior pouch absent. Abaxial lobes 0.5–2 mm long, 0.4–0.6 mm wide; wings 0.5–1 mm long, 0.8–1.2 mm wide; margin irregular. Adaxial corolla lobes 2/3 free, 1.6–2.5 mm long, 0.4–0.6 mm wide; auricle 0.6–0.8 mm long and wide; wing above auricle 0.2–0.5 mm long and wide; opposite wing 0.2–0.8 mm long and wide. Stamen filaments 1.5–2 mm long; anthers 0.2–0.4 mm long. Ovary 1.5–2 mm long, rounded at base, smooth or strigose; septum scarcely ½ ovary length; ovules 8. Style 2–3 mm long, glabrous; indusium broadly oblong to semi-circular, 0.3–0.5 mm long, 0.5–0.8 mm wide, straight or slightly concave at apex, glabrous or with a few hairs, brown; bristles 0.1–0.2 mm long, slightly longer on upper lip. Fruit ellipsoid 4–7 mm long, 2–3 mm wide, dehiscent almost to base. Seed elliptic, 1.6–2.1 mm long, 1.0–1.1 mm wide; alveolate at maturity, pale yellow to light brown; wing absent. Fig. 1. E–G.

Additional specimens examined: **Queensland.** Burke District: Girriri, Mornington Island, Sep 1981, *Fosberg* 61885 (BRI). Cook District: Welcome Creek Plateau, 13 km SSW of 'Battle Camp' via Cooktown, Jul 1990, *Bean* 1936 (BRI, NSW); 5.3 km SE of Hann River on Laura-Coen Road, Jul 1998, *Bean* 13528 (BRI); Moa Island, *c.*1 km NE of Kubin along road to St Pauls, Feb 1989, *Clarkson* 7783 (BRI); Namaleta Creek, May 1994, *Goble-Garratt* 186

(BRI); Upper reaches of Namelita Creek, Cape York on Venture Mine Lease, Apr 1994, *Gunness* 2333 (BRI). NORTH KENNEDY DISTRICT: Halfway between Townsville and Rollingstone, Apr 1945, *Blake* 15776 & *Webb* (BRI).

Distribution and habitat: North Queensland, from the Torres Strait islands to just north of Townsville, with one specimen from Mornington Island. Occurs in *Eucalyptus* and *Melaleuca* woodlands, with a grass, herb or sedge understorey, on sandy and podsolic soils, usually in damp areas, in and around seasonal watercourses. Map 1.

Phenology: Flowers February to September.

Affinities: This new species belongs in *Goodenia* section *Goodenia*, subsection *Borealis* Carolin (Carolin 1992). It is most closely related to *G. armstrongiana* de Vriese, differing mainly in the more narrow, linear-lanceolate leaves with entire margins, shorter corolla, fewer ovules, and an alveolate seed surface. *Goodenia armstrongiana* has a leaf L:W ratio of 2–5:1, usually dentate leaves, corolla 8–12 mm long, ovules 10–20 and seed surface verrucose.

***Conservation*:** This species, though apparently widespread, has rarely been collected. This may be due to the habitat, or its short lifespan. It is currently conserved in the Bulleringa National Park and does not appear to be rare or threatened at present.

3. Goodenia atriplexifolia A.E. Holland and T.P. Boyle, **sp. nov.** *G. viridulae* affinis sed foliis planus dentatus latioribusque et ovalis numerosioribus differens. **Typus**: Queensland. MITCHELL DISTRICT: 150 km S of Longreach on Jundah road, 2 km N of turnoff to Stonehenge, Mar 2001, *M.B.Thomas* 2255 & *N.Fechner* (holo: BRI; iso: DNA, PERTH).

Goodenia sp. (Stonehenge, J.Milson JM1426)

Woody subshrub to 30 cm tall. All parts grey or white tomentose with a dense felted mat of very fine white hairs. Leaves cauline, sessile; lamina elliptic to ovate, 0.8–2.8 cm long, 4–14 mm wide, L:W ratio (leaves and bracts) 2–3 (–5):1, apex acute, base cuneate or tapered, margins dentate or serrate, sometimes lobed, rarely entire, both surfaces grey tomentose; lowest leaves 3-veined. Inflorescence a leafy spike to 20 cm (more than ½ of the plant) with 1–3 flowers in the axils of leaf-like bracts; bracteoles absent or minute at base of calyx. Sepals adnate to ovary to summit, free part subequal, triangular, 1.0–1.4 mm long, 0.5–0.8 mm wide at base. Corolla 7–10 mm long, cream; outer surface tomentose; inner surface villous in throat, enations hidden or absent; anterior pouch absent. Abaxial corolla lobes 2–5 mm long, 1.0–1.6 mm wide, wings 2–4 mm long, 0.6–1.2 mm wide, margin irregular. Adaxial corolla lobes free almost to base, 4–5 mm long, 0.6–0.8 mm wide; auricle 1.8–2.0 mm long, 0.8–1.0 mm wide; wing above auricle absent; opposite wing 1.6–2.4 mm long, 0.2–0.8 mm wide. Stamen filaments 1.5–2 mm long; anthers *c.*1 mm long. Ovary 3–3.5 mm long, slightly narrowed at base, white tomentose; septum scarcely ½ ovary length; ovules 8–20. Style 2–3 mm long, with short spreading hairs; indusium oblong, 1.1–1.5 mm long, 0.7–1.0 mm wide, with short hairs at base, brown; upper lip convex, with bristles *c.* 3 mm long; lower lip shorter, concave, with very short bristles *c.* 0.05 mm long. Fruit ellipsoid to subglobular, 4–6 mm long, 2–4 mm wide, dehiscing almost to base. Seed elliptic to oblong, 2–3 mm long, 0.8–1.1 mm wide, with a thick rim, colliculate to minutely aculeate at maturity, yellow-brown; wing to 1 mm wide. Fig. 2. A–C.

***Additional specimens examined*: Queensland**. GREGORY NORTH DISTRICT: 18 km SW of Opalton, Nov 1986, *Neldner* 2616 (BRI). MITCHELL DISTRICT: Longreach to Jundah near Stonehenge, Jun 1977, *Cockburn* s.n. (BRI); 3 km NE of Stonehenge Main Turnoff, Aug 1988, *Milson* JM1426 (BRI); 22 km W of Vergemont HS SW of Longreach, Apr 1986, *Neldner* 2348 (BRI). GREGORY SOUTH DISRICT: Grey Range, 50 km W of Quilpie, Aug 1978, *Purdie* 1596 (BRI); 27.5 km from Cooma turnoff on road to Plevna Downs, Sep 1989, *Wilson* 443 (BRI, NSW).

***Distribution and habitat*:** Occurs in south-western Queensland, from Opalton south to the Grey Range, in tall *Acacia* shrubland and open *Eucalyptus* woodland, with *Triodia* understorey, on residual tablelands and rocky plateaus. Map 1.

***Phenology*:** Flowers June to September, possibly at other times.

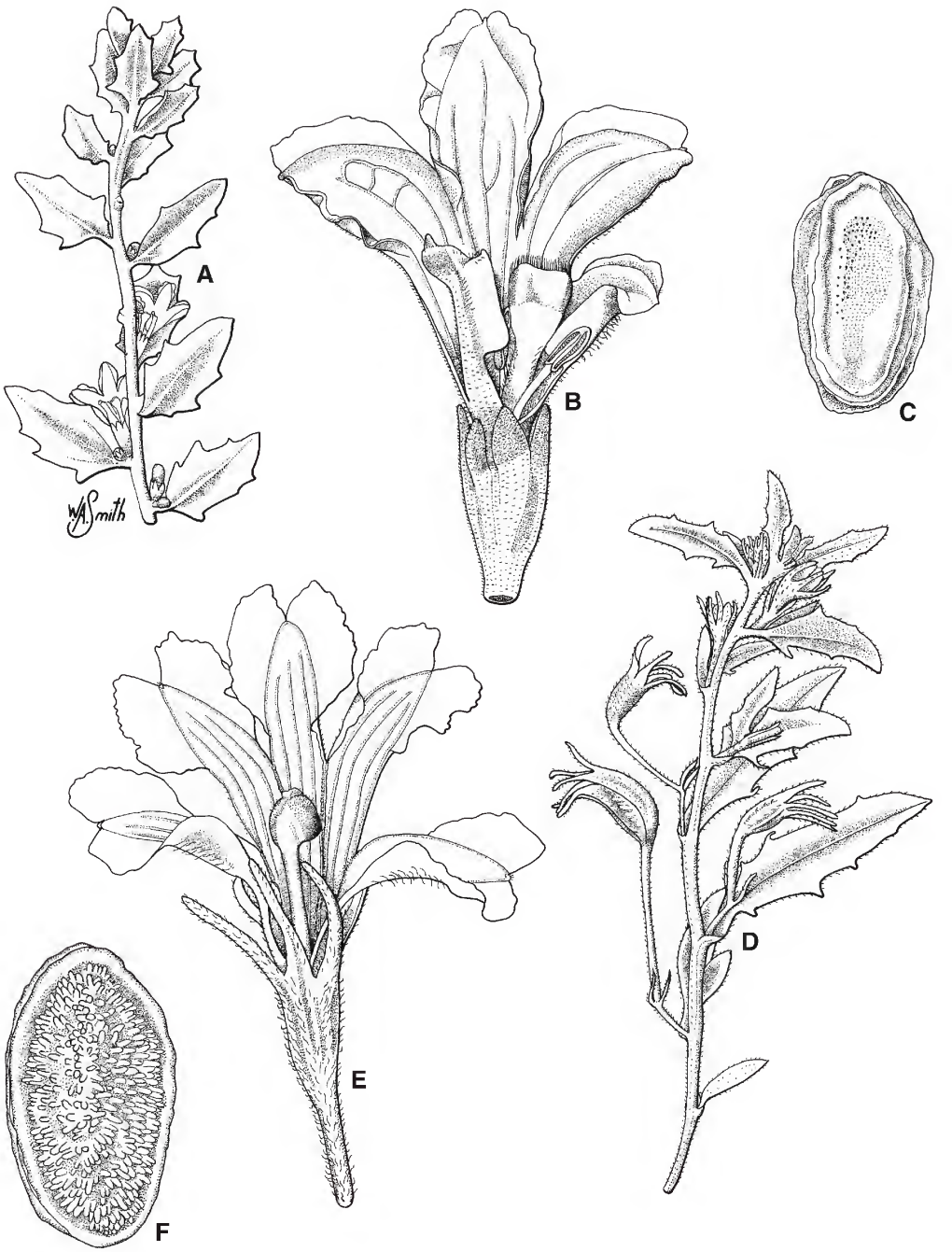


Fig. 2. ***Goodenia atriplexifolia.*** A, raceme; B, flower; C, seed. ***Goodenia expansa.*** D, raceme; E. flower; F. seed. A–C from *Milson* JM1426 (BRI); D–F from *Williams* 88038 (BRI).

***Affinities*:** This new species belongs in *Goodenia* section *Goodenia*, subsection *Goodenia* (Carolin 1992). It is most closely related to *G. viridula* Carolin, differing mainly in the much wider leaves which are flat and dentate, and by the more numerous ovules, and cream corolla. *Goodenia viridula* has terete leaves to 2 mm wide, 4–6 ovules and greenish corolla. It is also related to *G. disperma* F.Muell. but differs from this species in the wider leaves, sessile flowers with smaller sepals, and smaller fruits. *Goodenia disperma* has leaves to 5 mm wide, pedicellate flowers with sepals 4–9 mm long, and fruit 4–9 mm long.

***Etymology*:** The name refers to the leaves, which resemble those of *Atriplex* species.

Conservation: *G. atriplexifolia* does not occur in any conservation areas and is currently known only from five locations. Little is known of population sizes and distribution, although it has so far only been collected from jump-ups. Numbers of individuals have not been recorded. There are no known threats at the present time. It is recommended that this species be listed as DD (data deficient) under the IUCN (2001) red list categories and criteria.

4. Goodenia expansa A.E.Holland and T.P. Boyle, **sp. nov.** affinis *G. arenicola* et *G. geniculatae*, sed ab illa pedicellis et pedunculis brevioribus, racemis et sepalis longioribus et pilis multicellularibus grossis, ab hac corolla enationibus intus praedita, sepalis longioribus, absentia pilorum gossypinorum et ovulis numerosioribus differens. **Typus**: Queensland. GREGORY SOUTH DISTRICT: Cuddapan Station, Birdsville Development Road, about 4 km E of old homestead, 26 Sept 1988, *K.A.Williams* 88038 (holo: BRI).

Goodenia sp. (Cuddapan Station, K.A.Williams 88038)

Annual or short-lived perennial with a thickened root, initially tufted, then developing several to many prostrate leafy racemes to 60 cm, the whole plant spreading to 1 m diam. All parts of the plant hirsute with a mixture of spreading, ascending, curved or flexed white hairs, 0.1–0.8 mm long, the longer hairs multicellular. Leaves mostly basal, narrowing into a petiole 2–4 cm long; lamina narrowly elliptic to oblanceolate, 5–8 cm long, 5–20 mm wide, L:W ratio 4–14:1, apex acute, base tapered, margin dentate, or lobed with spreading acute lobes to 6 mm long, both surfaces hirsute, glabrescent. Inflorescence a leafy raceme to 60 cm long (more than ¾ of mature plant); flowers arising singly in axils of bracts, a few flowers arising basally; bracts smaller than leaves, sessile or nearly so, elliptic to obovate, 2–4 cm long, 5–10 mm wide, acute at both ends, dentate; flower stalk (pedicels and peduncles) geniculate at bracteoles at maturity; peduncles 6–30 mm long; pedicel 6–35 mm long; bracteoles linear, 6–9 mm long. Sepals adnate to ovary nearly to apex, free part subequal, linear, slightly folded, acute, 6–12 mm long, 0.6–1.0 mm wide. Corolla 15–20 mm long, pale yellow or cream; outer surface with a mixture of long and short hairs; inner surface hairy in throat, enations conspicuous; anterior pouch absent or obscure. Abaxial corolla lobes 6–8 mm long, 1.5–2.2 mm wide; wings 4–6 mm long, 1.7–2.6 mm wide; margin entire or irregular. Adaxial corolla lobes free almost to base, 10–14 mm long, 1.5–2.2 mm wide; auricle 3.5–6 mm long, 2.0–2.2 mm wide; wing above auricle 2–3 mm long, 0.7–1.5 mm wide; opposite wing 4–7 mm long, 1–2 mm wide. Stamen filaments 2–3 mm long; anthers 2.0–2.6 mm long. Ovary 5–8 mm long, 5-ribbed (ribs extending into sepals), tapered at base, with coarse spreading hairs on ribs, and soft tangled white hairs between ribs; septum *c.* 2/3 ovary length; ovules 28. Style 6–10 mm long, with scattered short and long hairs; indusium tightly folded, obtriangular, 2–2.5 mm long, *c.* 2 mm wide (folded), with a few scattered short hairs, brown; lips subequal with white bristles 0.1–0.2 mm long; Fruit ellipsoid, slightly curved, 8–13 mm long, 4–6 mm wide, the surface ribbed horizontally (over seeds) and vertically (along sepals) at maturity, dehiscing nearly to base. Seed flat, elliptic, 3–4 mm long, 1.8–2.4 mm wide, with a thick rim, tuberculate, yellow-brown; tubercles 1–3 mm long; wing absent. Fig. 2. D–F.

***Additional specimens examined*: Queensland**. GREGORY SOUTH DISTRICT: 180 km E of Monkira, near Windorah, Sep

1989, *Cowan* 131 & *Bushell* (BRI); 30 km E of Windorah, Oct 1984, *Neldner* 1619 (BRI); Windorah on roadside, Oct 1968, *Williams* 148 (BRI).

***Distribution and habitat*:** Occurs in south-western Queensland in the vicinity of Windorah, on sandplains dominated by *Triodia* species and *Corymbia terminalis*. Map 1.

***Phenology*:** Flowers and fruits in spring, probably after rain.

***Affinities*:** *Goodenia expansa* is very closely related to *G. arenicola* Carolin, sharing with this species, the folded indusium and tapered ovary. *G. expansa* differs from this species in the shorter pedicels and peduncles, longer sepals, long raceme development, hair type and ovule number. *Goodenia arenicola* has a minute, soft indumentum, pedicels and peduncles 30–40 mm long, sepals only 5–6 mm long, and 30–50 ovules. Unfortunately, only one specimen of *G. arenicola* exists (SYD) and the fruit are unknown. Both *G. arenicola* and *G. expansa* are closely related to the southern *G. geniculata* which also has a folded indusium, but G. *geniculata* lacks enations, and has oblong sepals only 4–5 mm long, cottony hairs, and only 14–16 ovules.

***Etymology*:** This species is named for the spreading habit, expanding from the basal tuft to up to 1m in diameter.

***Conservation status*:** *Goodenia expansa* does not occur in any conservation areas and is currently known only from four locations. Little is known of population sizes or area of distribution, although it has only been recorded from sandplains. Numbers of individuals has not been recorded. There are no known threats at the present time. It is recommended that this species be listed as DD (data deficient) under the IUCN (2001) red list categories and criteria.

5. Goodenia rosulata Domin, Biblioth. Bot. 89: 644 (1929). **Type:** Queensland. MITCHELL DISTRICT. Near Jericho, Mar 1910, *K.Domin* 8783; lecto: PR, fide R.C.Carolin, *Telopea* 3: 533 (1990)

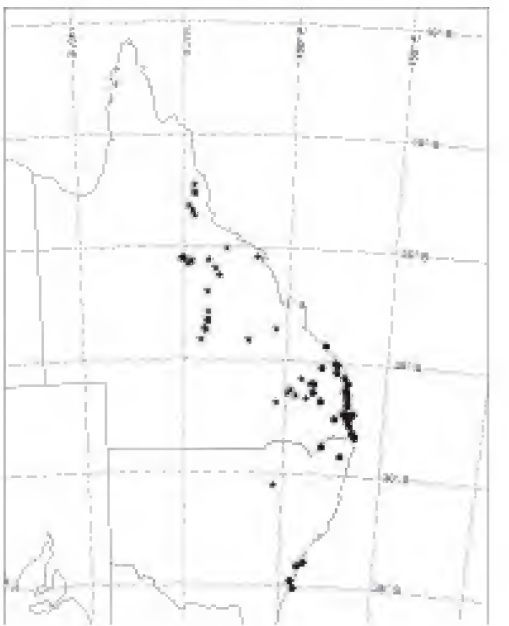
***Illustration*:** Domin loc. cit. p. 665 (Fig. 198).

Erect or ascending annual herb to 40 cm, rosulate. All parts sparsely to densely hirsute to pilose with a mixture of spreading, curved or flexed hairs to 1 mm long, rarely nearly glabrous. Leaves basal, gradually narrowed into a petiole to 5 cm long; lamina obovate to spathulate, 2–9 cm long, 1–3.5 cm wide, L:W ratio 1.5–3.5:1, apex rounded, base tapered, margin dentate or lobed with widely separated teeth/lobes, rarely entire, both surfaces hirsute or pilose, or nearly glabrous. Inflorescence a much branched panicle or thyrse to 25 cm long (approx. 2/3 of the plant), the branches spreading or ascending, often with a zigzag appearance; bracts linear to lanceolate, 4–10 mm long, 1–4 mm wide, acute, glabrous or sparsely hairy; pedicel 4–12 mm long, articulate *c.* 1 mm below ovary; bracteoles similar to bracts, 0.7–2.0 mm long. Sepals adnate to ovary nearly to apex, free part subequal, triangular to ovate, acute, 0.8–2.0 mm long, 0.4–0.8 mm wide, hairy or glabrous. Corolla 7–13 mm long, yellow; outer surface with a mixture of spreading simple hairs and short glandular hairs; inner surface glabrous or with a few hairs, enations absent; anterior pouch indistinct, shorter than the ovary. Abaxial corolla lobes 3–4 mm long, 0.8–1.2 mm wide; wings 2–2.5 mm long, 0.7–1.2 mm wide, entire. Adaxial corolla lobes 5.5–7 mm long, 0.8–1.2 mm wide; auricle indistinct, merged with wing 2.5–6 mm long, 1.0–1.7 mm wide; opposite wing 2–4 mm long, *c.* 1 mm wide, entire. Stamen filaments 2–3 mm long; anthers *c.* 1 mm long. Ovary 1–1.5 mm long, with a mixture of stiff spreading hairs and short glandular hairs, slightly ribbed; septum *c.* 2/3 ovary; ovules many. Style 3–7 mm long, with spreading hairs; indusium square to oblong or somewhat hemispherical, 0.8–1.2 mm long, 1.0–1.5 mm wide, with a few long hairs at base, white or purplish brown; bristles on lips subequal, to 0.1 mm long, tinged purple. Fruit obovoid, 2.8–4.0 mm long, 1.2–2.0 mm wide, dehiscing to base. Seed circular to elliptic, 0.3–0.5 mm long, smooth, pale brown or tan; wing *c.* 1 mm wide.

***Selected specimens*: Queensland.** COOK DISTRICT: Base of Mt Misch near Tolga, Mar 2000, *Ford* 2366 (BRI, QRS). NORTH KENNEDY DISTRICT: 2.7 km along Hollands road, W of Toumoulin, May 2000, *Bean* 16594 (BRI); 8 miles [12.8 km] W of Pentland on Hughenden road, Apr 1974, *Carolin* 8327 (BRI); 15 km W of Princess Hills towards Wairuna,

Apr 1997, *Cumming* 15931 (BRI, NSW); Warrigal on Great Dividing Range, Feb 1931, *Hubbard* 7125 & *Winders* (BRI); *c.* 12 miles [19.2 km] E of Lucy Hut on road leading to Oak Hills, Aug 1967, *Morain* 158 (BRI); 10 km E of Ravenswood, Leichhardt Range, Sep 1991, *Thompson* 466 & *Dillewaard* (BRI); White Mountain National Park near Warang, Mar 2000, *Wannan* 1615 (BRI, NSW). SOUTH KENNEDY DISTRICT: N of junction of Campaspe & Cape Rivers, Apr 1945, *Blake* 15734 & *Webb* (BRI); 8.9 km E of Gum Creek Dam on road to Carmichael-Ulcanbah turnoff, May 1991, *Neldner* 3419 & *Thompson* (AD, BRI). LEICHHARDT DISTRICT: *c.* 6 miles [9.6 km] N of Goowarra, Sep 1959, *Johnson* 937 (BRI); Zamia Range *c.* 3 miles [4.8 km] NNW of Springsure, Mar 1960, *Johnson* 1417 (BRI); 23.5 km E of St Anns homestead (Site 10/6-8), Jun 1992, *Thompson* BUC840 & *Sharpe* (BRI). MITCHELL DISTRICT: 'Yalleroi', 1946, *Clemens* s.n. (BRI); Wololla, SW of Jericho, Feb 1998, *Fensham* 3406 (BRI); 64 km E of Barcaldine, along Capricorn Hwy, Jun 1991, *Halford* Q414 (BRI, MEL, NSW); 9 km NW of Lennox homestead on road to Dunrobin, Mar 1992, *Thompson* GAL24 (BRI); Torrens Creek, Mar 1933, *White* 8709A (BRI). BURNETT DISTRICT: 7 km along Shelleytop Road, NE of Durong, Mar 1999, *Bean* 14712 (BRI, MEL); Brovinia State Forest, S of Mundubbera, Mar 1999, *Bean* 14723 (BRI, MEL); Toondahra, Langtree Creek, Langtree Paddock, Mundubbera Shire, Jan 1984, *Forster* 1712 (BRI). MARANOA DISTRICT: Clayhole Creek, 20 miles [32 km] S of Yuleba, Nov 1958, *Johnson* 653 (BRI). DARLING DOWNS DISTRICT: Nudley State Forest (SF 93), about 20 km NNW of Jandowae, Dec 1997, *Bean* 12666 (BRI, MEL); Moorra, *c.* 20 miles [32 km] ESE of Wandoan, Apr 1959, *Johnson* 767 (BRI); top of Main Range, near Gurulmundi, Nov 1930, *Hubbard* 5078 (BRI); Windarra near Chinchilla, Jul 1979, *Rennick* s.n. (BRI). **New South Wales.** Pilliga Forest between Narrabri and Coonabarabran, Nov 1963, *Pedley* 1608 (BRI).

***Distribution and habitat*:** This species occurs in inland districts, from Tolga in northern Queensland to the Pilliga State Forest in northern NSW, in *Eucalyptus*, *Melaleuca*, *Acacia*, or *Callitris* open woodland, often with *Triodia* species, in sandy soil. It has also been found in artesian springs and seasonally swampy areas. Map 2.



Map 2. Distribution of *Goodenia paniculata*● *and Goodenia rosulata*★.

***Phenology*:** Flowers all year, but most frequently from February to June.

***Discussion*:** *Goodenia rosulata* is distinguished from the related *G. paniculata* Sm., *G. macbarronii* Carolin and *G. lamprosperma* F.Muell., by the obovate to spathulate leaves, less than 4 times as long as wide, usually quite hairy, and often lobed. The mature inflorescence of *G. rosulata* has many short spreading branches, giving it a distinctive zigzag appearance.

Key to the Species of *Goodenia* in Queensland

Key to the Groups

1. Style branched, (2 or 3 indusia) **Group 1**
 Style not branched (one indusium) 2

2. Corolla blue, purple, mauve or red (may be yellowish in throat) **Group 2**
 Corolla yellow, white or green 3

3. Leaves up to 2 mm wide, terete or linear **Group 3**
 Leaves more than 2 mm wide, flat 4

4. Bracteoles absent **Group 4**
 Bracteoles present **Group 5**

Group 1

1. Plant lacking glandular hairs; sepals 3–5 mm long **G. pilosa** (R.Br.) Carolin
 Plant with glandular hairs; sepals 1.5–3 mm long 2

2. Pedicel articulate; fruit 7–13 mm long **G. berardiana** (Gaudich.) Carolin
 Pedicel not articulate; fruit *c.* 3 mm diameter (one record)
 **G. heteroptera** (F.Muell.) B.D.Jackson

Group 2

1. Corolla 1–3 mm long 2
 Corolla more than 3 mm long 3

2. Corolla 1–2 mm long, reddish; fruit 2–3 mm long **G. pumilio** R.Br.
 Corolla 2–3 mm long, bluish-purple; fruit 3–4 mm long **G. minutiflora** F.Muell.

3. Corolla 4–5 mm long (2 records) **G. paludicola** Carolin
 Corolla more than 5 mm long 4

4. Fruit 1–4 mm long; seed 0.4–0.7 mm long; corolla 5–12 mm long 5
 Fruit 7–20 mm long; seed 1.5–4.5 mm long; corolla 11–30 mm long 6

5. Corolla 5–7 mm long; fruit *c.* 1.5 mm long (2 records) **G. viscidula** Carolin
 Corolla 8–12 mm long; fruit 2–4 mm long **G. purpurascens** R.Br.

6. Leaves distinctly petiolate, lamina obtuse to cordate at base **G. grandiflora**
 Leaves sessile or lamina tapered at base into an indistinct petiole 7

7. Bracteoles absent; corolla without enations; indusium notched **G. vilmoriniae** F.Muell.
 Bracteoles present; corolla with enations; indusium not notched 8

8. Leaves glabrous; bracteoles obovate, rounded (one record) **G. azurea** F.Muell.
 Leaves usually hairy; bracteoles linear to lanceolate, acute 9

9. Leaves more than 2 cm wide; pedicel 1–4 mm long **G. ramelii** F.Muell.
 Leaves less than 2 cm wide; pedicel 3–8 mm long .. **G. splendida** A.E.Holland & T.P.Boyle

Group 3

1. Corolla greenish or white; stems cottony hairy 2
 Corolla yellow; stems glabrous or pubescent but without cottony hairs 3

2. Sepals 1–2 mm long; flowers sessile or nearly so; fruit 4–8 mm long ... **G. viridula** Carolin
 Sepals 4–5 mm long; flowers pedicellate; fruit 8–9 mm long **G. disperma** F.Muell.

3. Small shrub with woody stems **G. racemosa** F.Muell.
 Annual or perennial herb, not woody 4

4. Bracteoles absent 5
 Bracteoles present 6

5. Plant viscid or varnished; leaves absent or to 3 (–6) mm long;
 seed 3.5–4 mm diam. **G. armitiana** F.Muell.
 Plant not viscid; leaves mostly 4–10 cm long; seed 4–6 mm diam. . **G. triodiophila** Carolin

6. Sepals 1–1.4 mm long; indusium tightly folded (the sides touching) **G. gracilis** R.Br.
 Sepals 2.5–7 mm long; indusium flat 7

7. Outer surface of corolla stellate hairy **G. stelligera** R.Br.
 Outer surface of corolla glabrous **G. angustifolia** Carolin

Group 4

1. Sepals unequal, one more than twice the length of the others **G. redacta** Carolin
 Sepals all subequal 2

2. Flowers sessile or nearly so; pedicel less than 2 mm long 3
 Flowers distinctly pedicellate; pedicel more than 2 mm long 4

3. Corolla white, 7–10 mm long **G. atriplexifolia** A.E.Holland & T.P.Boyle
 Corolla yellow, 3–4 mm long **G. subauriculata** C.T.White

4. Corolla white; ovary distinctly spurred;
 fruit 12–15 mm long **G. calcarata** (F.Muell.) F.Muell.
 Corolla yellow; ovary spurred or not; fruit 3–10 mm long 5

5. Indusium tightly folded (the sides touching) **G. odonnellii** F.Muell.
 Indusium flat 6

6. Corolla glabrous outside **G. pinnatifida** Schltdl.
 Corolla variously hairy outside 7

7. Pedicel 2–5 mm long; plants glaucous **G. glauca** F.Muell.
 Pedicel more than 5 mm long; plants not glaucous 8

8. Indusium with one lip glabrous **G. lunata** F.M.Black
 Indusium with white bristles on both lips 9

9. Outer surface of corolla and ovary with glandular hairs 10
 Outer surface of corolla and ovary with simple hairs only 11

10. Stems prostrate or ascending, pubescent;
 seed 2–2.5 mm long **G. havilandii** Maiden & Betche
 Stems erect, glabrous; seed 3–4 mm long **G. janamba** Carolin

11. Corolla 4–8 mm long 12
 Corolla 8–25 mm long 14

12. Leaves mostly basal; flowers in subumbels **G. heteromera** F.Muell.
 Leaves mostly cauline; flowers in racemes 13

13. Corolla 4–6 mm long; leaves 0.5–3 mm wide, entire ... **G. debilis** A.E.Holland & T.P.Boyle
 Corolla 6–8 mm long; leaves 1.5–8 mm wide, denticulate **G. armstrongiana** de Vriese

14. Leaves stem clasping (auriculate); seed not winged **G. byrnesii** Carolin
 Leaves tapered at base; seed wing 0.2–1 mm wide 15

15. Indusium hemispherical; fruit 8–13 mm long **G. strangfordii** F.Muell.
 Indusium square or oblong or elliptic; fruit 5–8 mm long 16

16. Sepals 6–8 mm long; fruit with 1–4 seeds **G. megasepala** Carolin
 Sepals 1–5 mm long; fruit with 6 or more seeds 17

17. Ovary spurred **G. cycloptera** R.Br.
 Ovary not spurred 18

18.Stems stoloniferous; flowers in subumbels; seed 1.5–2.5 mm long . **G. heteromera** F.Muell.
Stems erect or prostrate, not stoloniferous; flowers mostly in racemes; seed 3–6 mm long 19

19.Leaves mostly entire; 3 abaxial lobes of corolla 5–10 mm long **G. fascicularis** F.Muell. & Tate
Leaves dentate or lobed; 3 abaxial lobes of corolla 4–5 mm long 20

20.Leaves to 3.5 cm long; sepals 1.5–2.5 mm long; seed 4.5–6 mm long **G. heterochila** F.Muell.
Leaves 3–10 cm long; sepals 3.5–5 mm long; seed 3–4 m long **G. hirsuta** F.Muell.

Group 5

1. Corolla white, cream or greenish 2
Corolla yellow 3

2. Leaves 10–35 mm wide; ovary with a distinct spur **G. calcarata** (F.Muell.) F. Muell.
Leaves 1–5 mm wide; ovary without a spur **G. disperma** F.Muell.

3. Shrubs to 2 m tall 4
Annual or perennial herbs to 80 cm 7

4. Leaves entire; pedicel to 3 mm long; corolla 12–15 mm long **G. racemosa** F.Muell.
Leaves dentate; pedicel more than 3 mm long; corolla 10–30 mm long 5

5. Leaves hairy; outer surface of corolla with glandular hairs **G. grandiflora** Sims
Leaves glabrous; outer surface of corolla glabrous or with simple hairs only 6

6. Plants viscid; leaves distinctly petiolate **G. ovata** Sm.
Plants not viscid; leaves tapered at base **G. stirlingii** F.M.Bailey

7. Outer surface of corolla with stellate hairs **G. stelligera** R.Br.
Outer surface of corolla with simple and/or glandular hairs or glabrous 8

8. Outer surface of corolla glabrous or glandular hairy, simple hairs sometimes also present.. 9
Corolla outer surface with simple hairs only 15

9. Indusium tightly folded (the sides touching) **G. gracilis** R.Br.
Indusium flat or nearly so 10

10.Corolla 14–18 mm long; fruit 10–15 mm long; seed 3.5–4 mm long **G. nigrescens** Carolin
Corolla 7–15 mm long; fruit 2–6 mm long; seed 0.5–1.5 mm long 11

11.Leaves cauline; pedicel not articulate; seed c. 1.5 mm long **G. heterophylla** Sm.
Leaves mostly basal; pedicel articulate; seed 0.3–0.8 mm long 12

12.Abaxial corolla-lobes (3 fan lobes) 1–3 mm long; indusium longer than wide **G. lamprosperma** F.Muell.
Abaxial corolla-lobes (3 fan lobes) 4–7 mm long; indusium square or wider than long 13

13.Leaves obovate to nearly orbicular, often lobed, L:W ratio 1.5–3.5:1 **G. rosulata** Domin
Leaves oblanceolate to linear, never lobed, L:W ratio 5–40:1 14

14. Corolla 7–9 mm long; pedicel 0–3 mm long **G. macbarronii** Carolin
 Corolla 9–15 mm long; pedicel 6–16 mm long **G. paniculata** Sm.

15. Indusium tightly folded (the sides touching) 16
 Indusium flat or nearly so 19

16. Cauline leaves distinctly lobed on one side at base (asymmetric), glabrous **G. glabra** R.Br.
 Cauline leaves ± symmetric at base; glabrous or hairy 17

17. Bracteoles 1–2 mm long; sepals 1–1.5 mm long **G. gracilis** R.Br.
 Bracteoles 5–12 mm long; sepals 5–12 mm long 18

18. Sepals 5–6 mm long (one record) **G. arenicola** Carolin
 Sepals 6–12 mm long **G. expansa** A.E.Holland & T.P.Boyle

19. Pedicel 40–70 mm long; corolla 15–25 mm long **G. strangfordii** F.Muell.
 Pedicel 0–20 mm long; corolla 7–17 mm long 20

20. Pedicel 0–1 mm long; fruit 2–4 mm long **G. bellidifolia** Sm.
 Pedicel usually more than 1 mm long; fruit 3–13 mm long 21

21. Corolla almost glabrous outside; ovary with glandular hairs **G. heterophylla** Sm.
 Corolla hairy outside; ovary lacking glandular hairs 22

22. Leaves 30–40 mm wide; seed circular, c. 3 mm long **G. goodeniacea** (F.Muell.) Carolin
 Leaves 2–30 mm wide; seed elliptic 2–2.5 mm long 23

23. Leaves linear to narrowly elliptic; sepals 2–2.5 mm long **G. delicata** Carolin
 Leaves orbicular to ovate to narrowly oblong; sepals 3–7.5 mm long 24

24. Bracteoles inserted 0–2 mm below ovary **G. rotundifolia** R.Br.
 Bracteoles inserted at least 5 mm below ovary **G. hederacea** Sm.

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Cupaniopsis cooperorum (Sapindaceae), a new species from the Wet Tropics, Queensland

Paul I. Forster

Summary

Forster, P.I. (2002). *Cupaniopsis cooperorum* (Sapindaceae), a new species from the Wet Tropics, Queensland. *Austrobaileya* 6 (2): 267–271. A new species from the Wet Tropics rainforest, *Cupaniopsis cooperorum* is described and illustrated. This species is restricted to complex notophyll vineforest on basalt derived substrates in the area around Topaz, Millaa Millaa and Butchers Creek. A conservation status of Vulnerable is recommended. A new key to the species of Australian *Cupaniopsis* is provided.

Keywords: *Cupaniopsis* – Australia; *Cupaniopsis cooperorum.*

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Introduction

The genus *Cupaniopsis* Radlk. comprises at least 60 species and is distributed in Malesia (New Guinea, Celebes, Moluccas), various islands in the Western Pacific and Australia (Adema 1991). Fourteen described species have been recognised for Australia (Reynolds 1985, 1991, 1997), although Adema (1991) only recognised twelve more broadly defined ones in his monograph. It is probable that additional species of *Cupaniopsis* exist in Australia (Reynolds 1997; Forster & Jessup 2002); however as yet, insufficient material is available for their description.

The subject of this paper, was brought to my attention in 1994 by Wendy Cooper of Topaz who had first collected specimens in January 1992. This and subsequent Cooper collections (*WWC* 106, 486, 487, 617, 627, 659, 849, 882, 970, 1065) have all been deposited in QRS. They were tentatively identified by B.Hyland of QRS as belonging to *Lepiderema.* In local colloquial usage in the 'Wet Tropics' of north-eastern Queensland, the plant was often referred to as 'Cooper's Puzzle'. Subsequent collections of flowering and fruiting specimens for BRI have enabled a critical examination of its characters, revealing that it actually represents an undescribed species of *Cupaniopsis.* Reynolds (1985) considered that the genus *Cupaniopsis* was distinguished by "the insides of the subglobose or obovoid capsules being villous, the cupular aril nearly enclosing the seed and sepals being usually silky outside". Adema (1991) considered *Cupaniopsis* as being primitive within Sapindaceae and that typical characters included the "dimorph sepals, the usually not crested petalar scales and the complete, often hairy disc; a pseudo-funicle is absent". This new species has the first and second characters of Reynolds, but not the third. The character of the sepals being silky outside is not diagnostic for the genus *Cupaniopsis* as nearly half the Australian species do not possess it (Reynolds 1985, 1991). The new species has 2-seriate sepals, non-crested scales on the petals, a complete and glabrous disc, and no funicle on the seed, thus fulfilling the generic requirements of *Cupaniopsis.*

Accepted for publication 4 July 2002

Taxonomy

Cupaniopsis cooperorum P.I.Forst., **sp. nov.** Proprius inter species Australianas foliis glabrus. Affinis *Cupaniopsis foveolatae* surculis glabris (strigosis comparate), foliis 3–5-jugatis ((5–) 6–8 (–12)-jugatis comparate), foliolis oblanceolatis vel raro ellipticis (angusto-ovatis usque angusto-ellipticis comparate), integris (crenatis comparate), domatiis absentibus, petalis late obovatis (ellipticis usque orbicularibus comparate) majoribus 2.8–3 × c. 0.5 mm (1–1.7 × 0.7–1.6 mm comparate),

seminibus nigris, 13–14 x 9–10 mm majoribus (8–8.5 × 6.5–7 mm comparate) differt. **Typus:** Queensland. Cook District: Wooroonooran National Park, end of Westcott Road, Topaz, 2 November 1999, *P.I.Forster* PIF25156, *R.Booth & W.Cooper* (holo: BRI [1 sheet + spirit]; iso: A, K, L, MEL distribuendi).

Lepiderema sp. (Topaz P.I.Forster+ PIF15478), Forster & Jessup (2002: 184).

Small tree to 7 m high, monoecious, often multistemmed; bark nondescript; blaze thin, yellow to straw; wood dense, straw. Branchlets ± smooth, brown-grey, glabrous; flowering twigs 2–4 mm thick. Leaves 3–5-jugate, often with a subterminal leaflet; petiole 52–70 mm long, terete, glabrous; rhachis 160–190 mm long, glabrous. Leaflets subopposite to strongly alternate, pergamentaceous, oblanceolate, rarely elliptic, 47–170 mm long, 15–55 mm wide, length-width index 2.5–3.8, glabrous, domatia absent; base oblique to cuneate; apex acute to shortly acuminate; margins flat, entire; both sides glabrous and glossy; venation of 10–13 pairs per side of the midrib, main lateral veins 3–12 mm apart, most venation looped and densely reticulate, on upper surface visible but with only the midrib slightly raised, on lower surface visible with both the midrib and main lateral veins raised; petiolules 5–17 mm long, slightly grooved, glabrous; pulvini 2–4 mm long, glabrous. Inflorescences axillary, not branching from base, 20–110 mm long, panicles, glabrous; bracts and bracteoles 0.5–0.8 mm long. Flowers 2.5–4 mm diameter, cream; pedicels 2–6 mm long, glabrous; sepals 2-seriate, weakly imbricate, ciliolate, externally glabrous, internally with short sparse indumentum in the lower half, outer ones broadly-elliptic, concave, 3–3.5 mm long, c. 2 mm wide, inner ones broadly ovate, 2.8–3 mm long, c. 2 mm wide; petals 5, broadly obovate, 2.8–3 mm long, c. 0.5 mm wide, externally with dense indumentum in lower half, apex margin irregularly lobed, scales present and densely pilose with antrorse indumentum; disc glabrous, c. 2.5 mm diameter. Stamens 8 (reduced to staminodes in female flowers), filaments 1–1.2 mm long, c. 0.3 mm wide, with dense indumentum along entire length, anthers c. 1 mm long and 0.5 mm wide, glabrous or with an occasional hair. Pistil: ovary 3-locular, 2.8–3 mm long, densely pilose, glabrescent; style and stigma c. 1.5 mm long, glabrous (reduced to pistillode in male flowers). Fruit with 2 or 3 well developed lobes, 15–20 mm high, 15–20 mm diameter, outside rugose to ribbed, glabrous, orange-pink, inside densely villous; stipe 2.5–3 mm long. Seeds ellipsoid-obovoid, 13–14 mm long, 9–10 mm wide, glossy black; hilum 0.5–1 mm wide, pseudohilum c. 3 mm wide; arillode orange, covering most of the seed. Fig. 1.

Additional specimens examined: Queensland. Cook District: Westcott Road, Topaz, Jul 1994, *Forster* PIF15478 & *Cooper* (BRI); ditto loc., Nov 1995, *Forster* PIF18185 *et al.* (BRI, MEL); Wooroonooran National Park, 3 km E of Butchers Creek, Nov 1998, *Forster* PIF23960 *et al.* (A, AD, BISH, BRI, K, L, MEL, NSW).

Distribution and habitat: *C. cooperorum* is quite restricted in its occurrence on the Atherton Tablelands in the Wet Tropics of Queensland, with populations observed from near Butchers Creek and Topaz to Zillie Falls near Millaa Millaa (W. Cooper pers. comm. Jan. 2002). Plants have been found in complex notophyll vineforest on red soils derived from basalt at altitudes between 600 and 900 m.

Notes: *C. cooperorum* is immediately recognisable amongst the Australian species of the genus by dint of its totally glabrous and glossy foliage with even young shoots lacking trichomes. For the purposes of diagnosis it is compared here to *C. foveolata* which is perhaps most similar in superficial appearances. *C. cooperorum* differs from *C. foveolata* in the young shoots being glabrous (versus strigose), the leaves 3–5-jugate (versus (5–) 6–8 (–12)-jugate) with oblanceolate or rarely elliptic leaflets (versus narrowly ovate to narrowly elliptic) that are entire (versus crenate), the absence of domatia, the petals broadly obovate (versus elliptic to orbicular) and larger (2.8–3 × c. 0.5 mm versus 1.0–1.7 × 0.7–1.6 mm) and the larger seeds (13–14 × 9–10 mm versus 8–8.5 × 6.5–7 mm) that are black (versus brown). A further superficial relationship may be possibly sought with *C. dallachyi* S.T.Reynolds, however that species is immediately recognisable by the leaves that are 6–7-jugate with much larger leaflets that

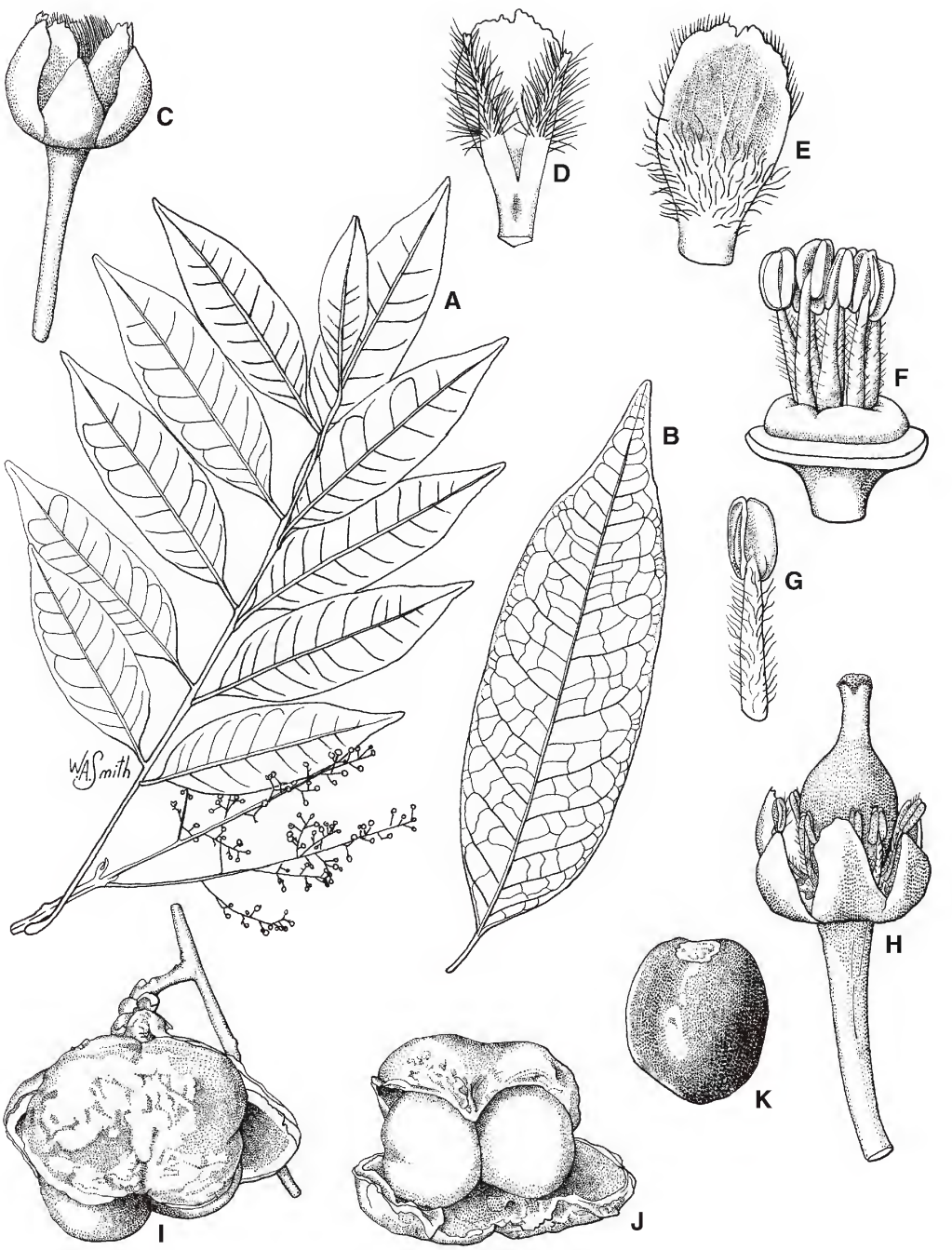


Fig. 1. ***Cupaniopsis cooperorum***. A. flowering twig with entire leaf. × 0.4; B. detail of venation in individual leaflet. × 0.8; C. side view of male flower, note outer sepals being longer than inner. × 6; D. internal view of petal showing two scales covered in indumentum and the irregular apex. × 12; E. external view of petal showing indumentum. × 12; F. side view of flower with perianth removed showing disk and stamens. × 9; G. stamen. ×12; H. side view of female flower, with staminodes. × 6; I. side view of dehiscing fruit. × 1.5; J. face view of dehiscing fruit with two seed in situ, both entirely covered by arillodes. × 1.5; K. face view of seed with hilum at top. × 2; A–H from *Forster* PIF25156 *et al.* (BRI); J–L from *Forster* PIF23960 *et al.* (BRI). Del. W.Smith.

are narrow-ovate and coriaceous. The flowers of *C. cooperorum* also appear to be unique in the genus in that the outer sepals are noticeably longer than the inner (Fig. 1C), which is the opposite of the other species in the genus (Adema 1991).

Although Adema (1991) presented a number of phylogenetic analyses based on morphological characters, he was unsatisfied with most of them and I feel it would be premature to attempt to relate this species to others in the genus in the absence of molecular data.

A new key is presented here to the Australian species of *Cupaniopsis* based in part on that published by Adema (1991), but including *C. parvifolia* (F.M.Bailey) L.A.S.Johnson and *C. simulatus* S.T.Reynolds as are currently recognised by the Queensland Herbarium. Collectors should ensure that they procure young shoot tips to accurately determine the character of stem apex indumentum.

Key to the Australian species of *Cupaniopsis*

1. Leaflets mainly cuneate, widest at or near apex 2
 Leaflets elliptic, ovate, obovate or oblanceolate, widest well below apex 3

2. Leaves 2–8(–10)-jugate, with pseudostipules. Leaflets spinose-dentate **C. shirleyana** (F.M.Bailey) Domin
 Leaves 1–2(–3)-jugate, without pseudostipules. Leaflets apically with 2–4 obtuse teeth, rarely entire **C. wadsworthii** (F.Muell.) Radlk.

3. Young stem-apices glabrous **C. cooperorum** P.I.Forst.
 Young stem-apices pubescent 4

4. Young stem-apices villous or tomentose (noticeably hairy) 5
 Young stem-apices strigose (finely puberulent) 9

5. Sepals internally glabrous. Fruits 15–20 mm long, 22–28 mm wide, internally glabrous **C. tomentella** (F.Muell. ex Benth.) S.T.Reynolds
 Sepals internally with appressed hairs, rarely glabrous. Fruits 9–20 mm long,13–18 mm wide, internally villous 6

6. Margin of leaflets entire. Fruit pericarp 2.4 mm thick or more ... **C. diploglottoides** Adema
 Margin of leaflets ± dentate to crenate. Fruit pericarp 0.5–1.8 mm thick 7

7. Teeth of leaflets hard. Inflorescences 1.5–6.5 cm long. Disc glabrous **C. serrata** (F.Muell.) Radlk.
 Teeth of leaflets soft. Inflorescences (6.5–) 11–60 cm long. Disc with hairs in five tufts ... 8

8. Petiole 3.5–9 cm long; leaves 4–10-jugate. Anthers hairy **C. flagelliformis** (F.M.Bailey) Radlk.
 Petiole 8–16 cm long; leaves (8–) 10–12-jugate. Anthers glabrous **C. newmanii** S.T.Reynolds

9. Leaflets crenate-dentate 10
 Leaflets entire 11

10. Trees over 10 m high. Leaflets with dome-shaped to pocket-like domatia. Fruits 18–22 x 18–20 mm; seeds 17–18 mm long, c. 9 mm wide **C. baileyana** Radlk.
 Shrubs or small trees to 12 m high. Leaflets with pustulate domatia. Fruits c. 15 x 13–15 mm; seeds 8–10 mm long, 6.5–7 mm wide .. **C. foveolata** (F.Muell.) Radlk.

11. Leaflets with domatia. Disc glabrous or short hairy all over 12
 Leaflets without domatia. Disc with hairs in 5 tufts 13

12.Leaves (2–) 4–6-jugate. Leaflets obovate, rarely elliptic. Inflorescences 4–20cm long **C. fleckeri** S.T.Reynolds
Leaves 6–7-jugate. Leaflets ovate to narrow-ovate. Inflorescences 17–25 cm long **C. dallachyi** S.T.Reynolds

13.Lateral nerve pairs in leaflets 2–5 mm apart **C. parvifolia** (F.M.Bailey) L.A.S.Johnson
Lateral nerve pairs in leaflets 6–20 mm apart 14

14.Small spreading tree to 15 m tall. Leaflet upper surface vernicose; reticulate venation fine. Fruits glabrous **C. anacardioides** (A.Rich.) Radlk.
Tall straight trees to 25 m tall. Leaflet upper surface slightly shiny; reticulate venation coarse. Fruits puberulent **C. simulatus** S.T.Reynolds

Conservation status: *C. cooperorum* is present in Wooroonooran National Park at Topaz and east of Butchers Creek. It can be quite locally common in some rainforest remnants in the area, e.g. Westcott Road. It has a quite restricted area of distribution (less than 100 km^2) and is known from only three populations. It fulfils the criteria of Vulnerable under the IUCN (2001) categories of B1, C2a, D2.

Etymology: This species is named for both Wendy and William (Bill) T. Cooper of Topaz, author and artist respectively of the book 'Fruits of the Rain Forest' published in 1994. The Coopers are currently working on a much expanded version of this book with many additional paintings and an expanded text.

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Studies in Euphorbiaceae A.L.Juss. *sens. lat.* 4.

A revision of *Monotaxis* Brongn. (Acalyphoideae Ascherson, Ampereae Müll.Arg.)

David A. Halford and Rodney J. F. Henderson

Summary

Halford, D.A. & Henderson, R.J.F. (2002). Studies in Euphorbiaceae A.L.Juss., *sens. lat.* 4. A revision of *Monotaxis* Brongn. (Acalyphoideae Ascherson, Ampereae Müll.Arg.). *Austrobaileya* 6(2): 273–292. The endemic Australian genus *Monotaxis* Brongn. is revised. Within *Monotaxis*, two sections and a total of eight species are recognized. *M.* sect. *Monotaxis* is comprised of *M. linifolia* Brongn., *M. occidentalis* Endl., *M. macrophylla* Benth., *M. luteiflora* F.Muell. and *M. tenuis* Airy Shaw, while *M.* sect. *Hippocrepandra* contains *M. bracteata* Nees, *M. grandiflora* Endl. (including *M. grandiflora* Endl. var. *grandiflora* and *M. grandiflora* var. *obtusifolia* F.Muell. & Tate) and *M. paxii* Grüning. All taxa are described and mapped, and notes on their distribution, habitat of occurrence and phenology are given. Lectotypes are chosen for *M. luteiflora* F.Muell., *M. megacarpa* F.Muell., *M. grandiflora* var. *obtusifolia* F.Muell & Tate and *M. paxii* Grüning. Identification keys to species and varieties are provided.

Key words: Euphorbiaceae, *Monotaxis*, Australian flora, taxonomy, nomenclature

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Introduction

Monotaxis Brongn. is a small endemic Australian genus found in all mainland states of the continent except for Victoria with its centre of diversity in south-western Western Australia. The genus was erected by Brongniart (1833) and included a single species, *M. linifolia.* It was based on collections made by Dumont d'Urville from near Port Jackson, New South Wales, in 1824. The name is derived from the Greek *monos*, single, and *taxis*, arrangement, a reference to the single row of stamens in male flowers. Over the subsequent 30 years, seven more species were described as belonging to this genus (Endlicher 1834 & 1837, Klotzsch 1845, Nees 1848, F. Mueller 1864).

In 1865, Müller Argoviensis described the genus *Hippocrepandra.* In his new genus, he included four species, two he renamed *H. neesiana* Müll.Arg. (*nom. illeg.* = *Monotaxis bracteata* Nees) and *H. ericoides* (Klotzsch) Müll.Arg. (= *Monotaxis grandiflora* Endl.), and two new species he named *H. gracilis* and *H. lurida.* Apparently he was unaware of Ferdinand Mueller's *M. megacarpa* of 1864 which would also have come within the circumscription of his new genus. *Hippocrepandra* was distinguished from *Monotaxis* by the habit of plants and the imbricate (quincuncial) calyx of their male flowers. At this time, Müller Argoviensis retained *Monotaxis* as a monotypic genus containing *M. linifolia* with three varieties namely *M. linifolia* var. *genuina* (*nom. inval.* = *M. linifolia* var. *linifolia*), *M. linifolia* var. *tridentata* (based on *M. tridentata* Endl.) and *M. linifolia* var. *occidentalis* (based on *M. occidentalis* Endl.).

Baillon (1866), however, reduced *Hippocrepandra* to a section of *Monotaxis.* Within *Monotaxis*, he recognised two sections, *Monotaxis* sect. *Linidion* (= *Monotaxis* sect. *Monotaxis*) containing a single species, *M. linifolia*, with only two varieties, *M. linifolia* var. *linifolia* and *M. linifolia* var. *occidentalis* (based on *M. occidentalis* Endl.), as well as *Monotaxis* sect. *Hippocrepandra* containing *M. grandiflora* Endl., *M. megacarpa* F.Muell., *M. gracilis*

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(Müll.Arg.) Baill. (based on *Hippocrepandra gracilis* Müll.Arg.), *M. neesiana* (*nom. illeg.* = *M. braceata* Nees) and *M. oldfieldii* Baill. He distinguished these sections on the basis of inflorescence structure, and the number and aestivation of male sepals.

Bentham (1873) followed Baillon in treating *Hippocrepandra* as congeneric with *Monotaxis* and maintained his sectional divisions. He recognized *Monotaxis* sect. *Eumonotaxis* (*nom. inval.* = *Monotaxis* sect. *Monotaxis*) as including *M. linifolia* Brongn. (for which *M. tridentata* Endl. was listed as a synonym), *M. occidentalis* Endl. (for which *M. cuneifolia* Klotzsch was listed as a synonym) and a new species, *M. macrophylla* Benth. For *Monotaxis* sect. *Hippocrepandra* he included *M. grandiflora* Endl. (for which *M. ericoides* Klotzsch and *M. bracteata* Nees were listed as synonyms), *M. megacarpa* F.Muell., *M. gracilis* (Müll.Arg.) Baill. and *M. lurida* (Müll.Arg.) Benth. (for which *M. oldfieldii* Baill. was listed as a synonym).

In the most recent account of *Monotaxis* as a whole, Grüning (1913) also maintained Baillon's two sections and enumerated nine species including a new species *M. paxii* in *M.* sect. *Hippocrepandra*. Two other species of *Monotaxis* have been described since Grüning's publication, namely *M. stowardii* S.Moore (1920) and *M. tenuis* Airy Shaw (1980).

As a result of the present study, only eight species are now recognized in the genus *Monotaxis*. We support recognition of two infrageneric sections as circumscribed by Baillon and followed by Bentham and Grüning, namely *Monotaxis* sect. *Monotaxis* and *M.* sect. *Hippocrepandra*.

Monotaxis is currently classified with *Amperea* in subfamily Acalyphoideae Ascherson and tribe Ampereae Müll.Arg. (Webster 1994). *Amperea* was revised by Henderson (1992) who suggested that perhaps *Monotaxis* and *Amperea* should be united. However, before such major changes are made, detailed studies need to be made of these two taxa, particularly of their leaf and stem anatomy. The retention of these groups as separate genera is supported by differences in anther morphology, and the presence or absence of petals in male flowers respectively.

Methods

The present study involved examination of herbarium specimens by the authors, together with field investigations by the second author from 1988 to 1992. Altogether, approximately 400 specimens have been examined and annotated. These comprise collections from the following herbaria: B, BRI, CANB, K, LD, MEL, NSW and PERTH. The above acronyms and ones used in the text to indicate herbaria holding particular specimens are those given by Holmgren *et al.* (1990). Author abbreviations follow Brummitt & Powell (1992). All specimens cited have been seen unless otherwise indicated (as *n.v.*).

Descriptions of taxa were made from dried herbarium specimens, material preserved in 70% ethanol or dried material reconstituted by placing in boiling water for a few minutes. Measurements listed are based upon the total variation observed in the herbarium specimens examined. Colour of fresh vegetative and floral parts where given are either from herbarium label notes or from photographs taken by the second author during field studies. Plant size, habit, flowering and fruiting times, and habitat data were obtained from herbarium labels. The morphological data for this revision were recorded using the DELTA system (Dallwitz *et al.* 1993). The distribution maps were produced with MapInfo Version 3 and are based on herbarium specimen locality data.

Taxonomy

Monotaxis Brongn., Annal. Sci. Nat. Paris, ser. 1, 29: 386 (1833) and in Duperrey, Voy. monde 224, t.49B (1834) ('1829'). **Type:** *M. linifolia* Brongn.

Hippocrepandra Müll.Arg., Linnaea 34: 61 (1865). **Type:** *H. gracilis* Müll.Arg. (= *M. bracteata* Nees; lectotype designated by Wheeler (1975)).

Monoecious or rarely dioecious, annuals or herbaceous perennials. Stems erect, ascending or decumbent, sparingly to much-branched; branchlets ± terete, smooth, papillose or striate,

hollow or filled with pith. Leaves alternate, subopposite or subwhorled, stipulate, sessile or shortly petiolate; laminae simple, entire or toothed. Stipules entire or deeply lobed, persistent. Inflorescences braceate, of sessile or pedunculate, terminal, head-like, compound cymes. Flowers sessile or on articulate pedicels, gamosepalous; calyx deeply lobed; corolla present or absent; disc present. Male flowers usually numerous per cyme; calyx lobes 4 or 5, valvate or imbricate; petals always present, 4 or 5, clawed, proximally cordate or auriculate with lobes inrolled around adjacent staminal filament; disc of 4 or 5 discrete glands; glands antisepalous, stalked, glabrous or with a tuft of simple hairs distally; stamens 8 or 10(rarely 11); filaments free; anthers 2-celled; anther cells subglobose, free, divergent to pendant on a conspicuous transverse connective, dehiscing by ± longitudinal slits; rudimentary ovary present or absent. Female flowers 1 or many per cyme; calyx lobes 5(or 6), imbricate, persistent, appressed to fruit; petals absent or when present 5, clawed and persistent; disc of 3–10 discrete glands or a continuous ring around ovary; ovary 3-locular, smooth, glabrous; locules uniovulate; ovules pendulous; styles 3, shortly fused at base, spreading, deeply bifid, fimbriate or lobed, persistent. Fruit capsular, ovoid, ellipsoid or subglobose, usually shallowly 3-lobed, smooth or slightly rugose, glabrous, dehiscing septicidally into 3 bivalved segments leaving a persistent columella. Seeds obloid, ellipsoid or ovoid to globose, smooth or rugose, shiny, carunculate.

A genus of 8 species endemic in tropical and temperate Australia.

Key to species of *Monotaxis*

1. Petals of male flowers shorter than sepals 2
 Petals of male flowers longer than sepals 6

2. Annuals or short lived herbaceous perennials to 90 cm high; stems sparingly to much branched, ascending to erect (rarely decumbent), up to 5 mm across; stipules ≥ 0.7 mm long 3
 Herbaceous perennials to 20 cm high; stems sparingly branched, prostrate, decumbent to ascending, up to 0.9 mm across; stipules < 0.7 mm long 5

3. Leaves acute-toothed; inflorescences on slender peduncles 0.2–0.3 mm across **5. M. tenuis**
 Leaves entire or obtuse-toothed; inflorescences on stout peduncles 0.4–0.9 mm across 4

4. Staminal filaments 1.9–2.5 mm long; seeds obloid **4. M. luteiflora**
 Staminal filaments 1.0–1.8 mm long; seeds ellipsoid and slightly dorsi-ventrally flattened **3. M. macrophylla**

5. Stems with smooth longitudinal ridges; petals of male flowers with apex obtuse to rounded **1. M. linifolia**
 Stems with crenate longitudinal ridges; petals of male flowers with apex acute **2. M. occidentalis**

6. Leaf laminae ± flat or somewhat concave; adaxial leaf surface foveate **8. M. paxii**
 Leaf laminae with recurved or revolute margins; adaxial leaf surface ± smooth 7

7. Stems smooth; leaf laminae with revolute margins obscuring abaxial leaf surface except for midrib **7. M. grandiflora**
 Stems smooth or papillose; leaf laminae dark green, with recurved or revolute margins not obscuring all of the abaxial leaf surface **6. M. bracteata**

Monotaxis Brongn. sect. **Monotaxis,** Baill., Adansonia 6: 291 (1866). **Type:** *M. linifolia* Brongn.

Monotaxis sect. *Linidion* Baill., Adansonia 6: 291 (1866), *nom. inval.*

Monotaxis sect. *Eumonotaxis* Benth., Fl. Austral. 6: 78 (1873), *nom. inval.*

Monoecious annuals or short-lived herbaceous perennials; stems hollow. Leaves widely spaced with internodes 20–70 mm long; laminae with margins entire or coarsely toothed, flat or rarely slightly to strongly recurved. Inflorescences sessile or pedunculate. Male flowers 4(rarely 5)-merous; calyx valvate, with sessile glands on abaxial surface; petals shorter than calyx lobes; antisepalous glands glabrous; stamens 8(rarely 10); connective stout; rudimentary ovary absent or rarely present. Female flowers 5(rarely 6)-merous; calyx imbricate, with sessile glands on abaxial surface; petals absent or rudimentary; styles stout, fimbriate.

***Distribution*:** The species of *Monotaxis* sect. *Monotaxis* occur in Western Australia, Northern Territory, South Australia, Queensland and New South Wales.

1. Monotaxis linifolia Brongn., Ann. Sci. Nat. (Paris) 29: 387 (1833); *Monotaxis linifolia* Brongn. var. *linifolia*, Müll.Arg., Linnaea 34: 63 (1865). **Type:** (New South Wales.) Port Jackson, (without date,) *d'Urville* (holo: P).

Monotaxis tridentata Endl., Atakta bot. 8/9, t.8 (1834)('1833'); *Monotaxis linifolia* var. *tridentata* (Endl.) Müll.Arg., Linnaea 34: 63 (1865). **Type:** (New South Wales.) Nova-Hollandia, (without date,) *Sieber* (holo: W; iso: G-DC *n.v.*, microfiche IDC 800-73. 2456: I. 7).

Monotaxis linifolia var. *cuneata* Grüning in A.Engler, Pflanzenr. H.58: 81 (1913). **Type:** New South Wales. Port Jackson, (without date,) *R. Brown* (holo: ?; iso: BM *n.v.* (transparenies at BRI), K).

Monotaxis linifolia var. *genuina* Müll.Arg., Linnaea 34: 63 (1865), *nom. inval.*

Monotaxis linifolia var. *genuina* Grüning in A.Engler, Pflanzenr. H.58: 81 (1913), *nom. inval.*

***Illustrations*:** G. Grüning (1913: 80, fig.13 A-D); T.A. James and G.J. Harden (1990: 405).

Glabrous, monoecious, diffuse, herbaceous perennials to 20 cm high, with few to many stems arising from a rootstock. Stems sparingly branched, decumbent to ascending, up to 0.8 mm across; young branchlets striate, pale green; striae smooth. Leaves subsessile, alternate, subopposite or subwhorled distally on branchlets; stipules triangular, 0.4–0.5 mm long, with apex acute and margins entire, pale green; laminae linear or narrowly elliptic, 5–13 mm long, 0.9–1.5 mm wide, with base attenuate and apex acute, flat with margins entire or sometimes 3-toothed distally and slightly to strongly recurved, smooth adaxially and abaxially, slightly discolorous, crustaceous when dried; midrib slightly impressed adaxially, prominent abaxially. Inflorescence sessile or sometimes pedunculate when peduncles slender, 1–3 mm long and 0.1–0.4mm across; bracts numerous; outer bracts ovate, 0.9–1.1 mm long, with margins entire or toothed distally, pale green. Male flowers 6–9 per cyme; pedicels 1.4–1.7 mm long; calyx lobes ovate-elliptic, 1.3–1.4 mm long, c. 0.7 mm wide, with apex acute to obtuse and margins entire, flat, pale green with maroon coloured mottling; petals reniform, 0.7–0.8 mm long including claw, 0.8–1 mm wide, with base cordate, apex obtuse to rounded and margins entire, white; glands c. 0.1 mm long, glabrous; staminal filaments 0.7–0.8 mm long; anthers 0.2–0.3 mm long; connective tissue 0.2–0.4 mm long; rudimentary ovary present with 1 or 2 erect linear lobes; lobes up to 0.5 mm long. Female flowers 1 per cyme, sessile; calyx lobes ovate, 1–1.4 mm long, 0.7–0.8 mm wide, with apex obtuse and margins ± entire, slightly concavo-convex, green; petals absent; glands 5, 0.7–0.9 mm long; ovary trigonal-globose, c. 1.5 mm across and 1.3 mm long; styles 0.7–1.3 mm long, 2-lobed; lobes c. four-fifths the length of style. Capsule ovoid, 2.3–2.6 mm long, 1.9–2.1 mm across, smooth or ± rugose distally. Seeds not seen. Fig. 1.

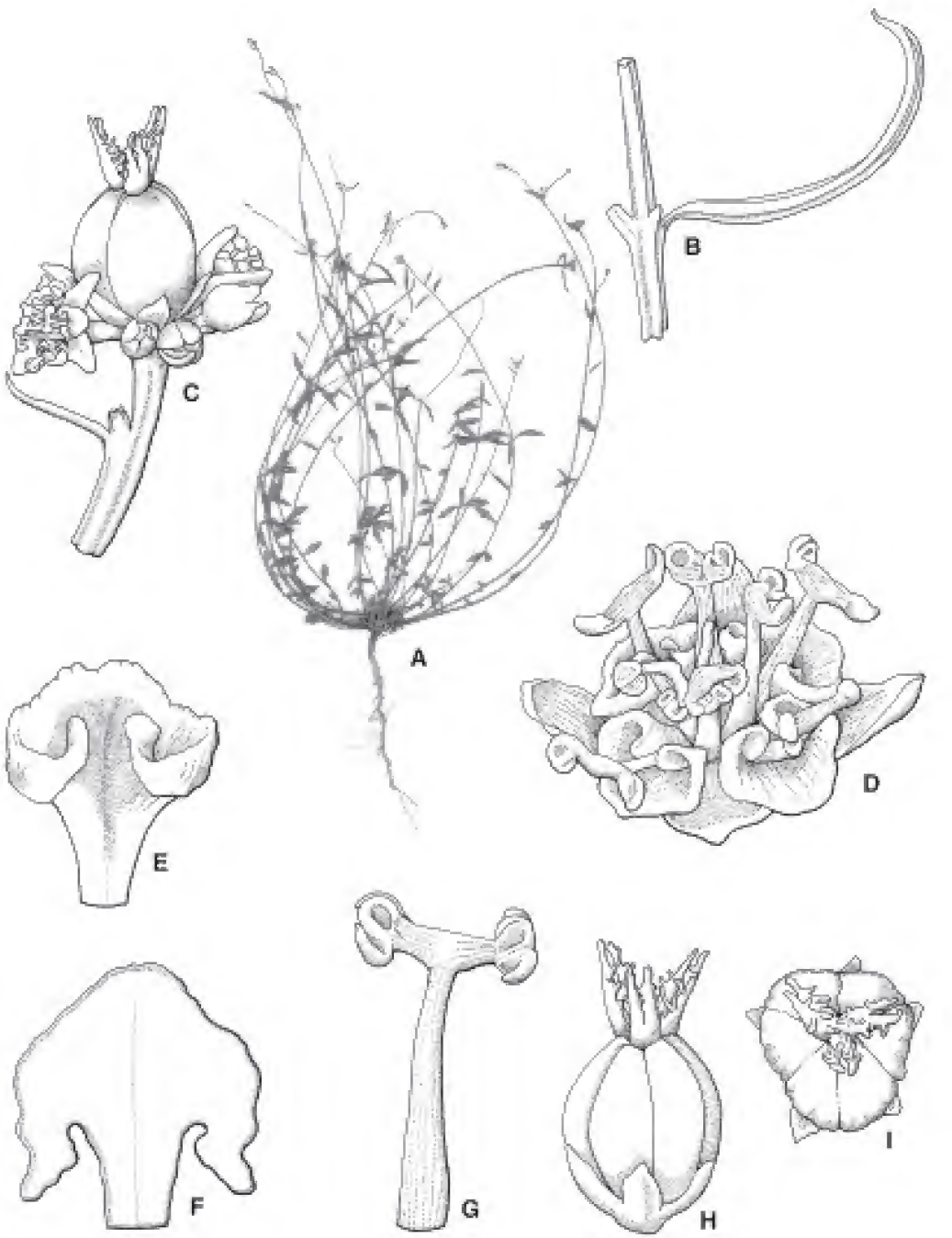


Fig. 1. ***Monotaxis linifolia*.** A. habit. ×0.5. B. section of branchlet with stipule and leaf. ×8. C. flowering branchlet. ×8. D. male flower. ×20. E. adaxial view of petal of male flower. ×40. F. adaxial view of petal of male flower, flattened out. ×40. G. abaxial view of antipetalous stamen. ×40. H. fruit from side. ×8. I. fruit from above. ×8. A–I from *Coveny et al.* 17343 (BRI). Del. W. Smith.

***Selected specimens (from 30 examined)*: Australian Capital Territory.** 0.9 miles (c. 1.4 km) S of Jervis Bay by road on the Wreck Bay Road, Oct 1971, *Coveny* 3770 (NSW); Australian National Botanic Gardens, Jervis Bay Annexe, Aug 1991, *Lyne* 336 & *Rudd* (CANB, MEL, NSW); Jervis Bay, bridge on the Wool road, c. 0.7 miles (1.1 km) SW of Vincentia, Jan 1972, *Berg* RYB698A (CANB). **New South Wales.** Wisemans Ferry road, Gosford, Jan 1926, *Blakely* & *Shiress* (NSW); Tuggerah, Oct 1900, *Boorman* (NSW); Narrow Neck, Katoomba, Dec 1961, *Burgess* (CANB); Katoomba, Dec 1908, *Camfield* (NSW); Pile Road, Somersby Industrial Estate, Sep 1996, *Coveny* 17343 *et al.* (BRI, MEL, NSW); Belrose, Nov 1981, *Coveny* 11063 & *Hind* (NSW); La Perouse, May 1976, *Coveny* 7663 & *Davies* (NSW); DeeWhy Lagoon, c. 10 miles (16 km) NNE of Sydney, Jul 1966, *Coveny* (NSW); Bateau Bay, near The Entrance, Tuggerah Lake, Mar 1970, *Johnson* & *Briggs* BGB3249 (NSW); Mt Ausley, near Wollongong, Nov 1949, *McBarron* 4079 (NSW); 3 miles (c. 4.8 km) S of Audley, Royal National Park, Mar 1971, *O'Hara* & *Coveny* 3558 (NSW); 1.35 km ESE of Nerriga, Sep 1971, *Pickard* 1673 (NSW); Royal National Park, Sir Bertram Stevens Drive, Sep 1986, *Rodd* 5610 *et al.* (NSW); 10 miles (c. 16 km) SE of Robertson, Oct 1943, *Rodway* (NSW); Mount Pigeon House, Milton, Nov 1917, *Rodway* (NSW); Cowan Station-Jerusalum Bay, Nov 1954, *Salasoo* 1243 (NSW); Budawang Range, Mt Currockbilly, Dec 1973, *Sikkes* & *Telford* BR402 (BRI, CANB, NSW).

***Distribution and habitat*:** *Monotaxis linifolia* is confined to subcoastal and coastal areas of New South Wales and the Australian Capital Territory, from Tuggerah Lake southwards to Budawang Range (Map 1). It is recorded as growing in heathland, mallee and open eucalypt forest communities, on mostly damp sandy soils overlying sandstone, on creek banks, hillslopes and ridges.

***Phenology*:** Flowers have been collected throughout the year, particularly from September to December, fruits in November and January.

***Notes*:** *Monotaxis linifolia* is most closely related to *M. occidentalis* but differs from that by its smooth rather than crenate longitudinal ridges on the stems, its petals in male flowers obtuse to rounded rather than acute at the apex, and having a rudimentary ovary present in male flowers.

2. Monotaxis occidentalis Endl., Enum. pl. 19 (1837); *Monotaxis linifolia* var. *occidentalis* (Endl.) Müll.Arg., Linnaea 34: 63 (1865). **Type:** (Western Australia.) Swan River, (without date,) (*K.A.A.F.*) *Hügel* (holo: W *n.v.* (transparencies at BRI)).

Monotaxis cuneifolia Klotzsch in Lehm., Pl. Preiss. 1: 176 (1845). **Type:** (Western Australia.) Guildford, Perth, 14 Sep 1839, *L. Preiss* 1222 (holo: LD; iso: K (ex herb. Benth.), G-DC *n.v.*, microfiche IDC 800-73. 2456: I. 8, MEL [MEL2065969, MEL2065971, MEL2062924 (ex herb. Sonder)]).

Glabrous, monoecious, diffuse to compact, herbaceous perennials to 20 cm high, with few to many stems arising from a rootstock. Stems sparingly branched, prostrate or ascending, up to 0.9 mm across; young branchlets striate, pale green; striae crenate. Leaves petiolate, mostly alternate or subopposite distally on branchlets; stipules triangular, 0.2–0.5 mm long, with apex acute and margins entire, red-brown; petiole c. 0.5 mm long, plano-convex in transverse section; laminae narrowly obovate to obovate or narrowly elliptic to broadly elliptic or rarely ovate, (2.3–)6–12 mm long, 1–3 mm wide, with base cuneate or rarely truncate and apex acute and shortly apiculate, flat, with margins entire and slightly recurved, smooth adaxially and abaxially, ± concolorous, crustaceous and somewhat wrinkled when dried; midrib obscure adaxially, prominent abaxially. Inflorescence sessile; bracts numerous; outer bracts ovate to broadly ovate, 0.7–1 mm long, with margins entire, brown. Male flowers 4–9 per cyme; pedicels 0.5 to 0.9 mm long; calyx lobes narrowly ovate or ovate-elliptic, 1.1–1.6 mm long, 0.5–0.8 mm wide, with apex acute to shortly acuminate and margins entire, ± flat but slightly recurved distally, of unknown colour when fresh; petals ovate to broadly ovate, 0.8–1.2 mm long including claw, 0.7–0.9 mm wide, with base deeply cordate, apex acute and margins entire, coarsely toothed or somewhat undulate, white; glands up to 0.2 mm long, glabrous; staminal filaments 0.6–1 mm long; anthers c. 0.2 mm long; connective tissue c. 0.2 mm long; rudimentary ovary absent. Female flowers 1 or 2 per cyme, sessile; calyx lobes narrowly ovate to ovate, 1.2–1.5 mm long, 0.5–0.6 mm wide, with apex acute to shortly acuminate and margins entire, concavo-convex, of unknown colour when fresh; petals absent; glands forming a continuous deeply 5–9-lobed ring, with lobes 0.5–0.7 mm long; ovary trigonal-ellipsoid, 0.7–1 mm across and 1–1.2 mm long; styles 1.0–

1.3 mm long, deeply 2-lobed; lobes four-fifths the length of style. Capsule ovoid, 2–3.2 mm long, 1.5–1.9 mm across, ± rugose distally. Seeds obloid, 1.1–1.6 mm long, 0.6–0.8 mm wide, 0.5–0.6 mm deep; testa smooth, brown; caruncle sagittate in outline, 0.4–0.5 mm long, 0.4 mm across, white.

***Selected specimens (from 24 examined)*: Western Australia.** Guildford, Sep1901, *Andrews* (PERTH); Dwellingup, Nov 1942, *Burbidge* (PERTH); 8 km N of Bullsbrook, Nov 1984, *Cranfield* 5025 (PERTH); Gravel Reserve, Howell Road, off South Coast Highway, W of Albany, Oct 1990, *Croxford* 1 (BRI); Gnangarra, Oct 1945, *Gardner* (PERTH); Pinjarra, Murray River, Sep 1897, *Helms* (PERTH); Bow River, Nov 1912, *Jackson* (NSW); 3 miles (c. 5 km) SE of Bunbury on Boyanup road, Jan 1970, *Keighery* 988 (PERTH); Lowden, 1909, *Koch* 1946 (MEL, PERTH); Kelmscott, Dec 1900, *Morrison* (BRI); Yallingup National Park, Jul 1974, *Orchard* 4314 (CANB, PERTH); Northcliffe-Pemberton district, Oct 1962, *Phillips* 2595A (CANB); Marriott Road between Brunswick and Rosamel, Middle Wellesley River, Dec 1974, *Pullen* 9839 (CANB, PERTH); c. 10 km W of Cookernup, Dec 1974, *Pullen* 9834 (CANB); 15 miles (c. 24 km) W of Gingin, Dec 1953, *Royce* 4725 (PERTH); 5 miles (c. 8 km) SW of Nannup, Sep 1966, *Scrymgeour* 1207 (PERTH); 11 miles (c. 18 km) along Stewart Road towards Augusta, Oct 1966, *Scrymgeour* 1610 (PERTH); Jandakot Marsupial Breeding Station, Lake Banganup, Oct 1974, *Weston* 9760 (PERTH); Scott River, Dec 1978, *Wittwer* W2251 (CANB, PERTH).

***Distribution and habitat*:** *Monotaxis occidentalis* is confined to the south-west of Western Australia where it occurs in coastal to subcoastal areas from near Gingin southward to the Bow River area and east to Walpole (Map 2). It is recorded as growing in heathland, *Banksia* and *Casuarina* woodland, and *Eucalyptus marginata* and *Casuarina* woodland communities, on grey or white sandy soils on sand plains, rarely on gravelly loam soils. It is also recorded in *Melaleuca* woodland communities in swampy areas on black peaty or clayey sands.

***Phenology*:** Flowers and fruits have been collected from September to January.

***Notes*:** *Monotaxis occidentalis* is the only species in *M.* sect. *Monotaxis* that occurs in Western Australia. It is most closely related to *M. linifolia* in eastern Australia. For differences from *M. linifolia*, refer to notes under that species.

Typical specimens of *M. occidentalis* have a diffuse habit and narrowly obovate to obovate or narrowly elliptic to broadly elliptic leaf laminae measuring 6–12 mm long. The collections *Phillips* 2595A (CANB), *Jackson* [NSW273987](NSW), *Scrymgeour* 1610 (PERTH) and *Croxford* 1 (BRI) from between Augusta and Walpole have a smaller, compact habit and smaller, ovate leaf laminae which are only 2–3 mm long. This variation may be worth formal recognition and warrants further field studies of this taxon.

3. Monotaxis macrophylla Benth., Fl. Austral. 6: 79 (1873). **Type:** (New South Wales/ Queensland.) summit of Mount Danger, Moreton Bay, (without date,) *A. Cunningham* (holo: K *n.v.* (cibachrome at BRI)).

***Illustrations*:** G.M. Cunningham *et al.* (1982: 459); T.A. James and G.J. Harden (1990: 404).

Glabrous, monoecious, fruticose annuals or short-lived herbaceous perennials to 90 cm high, with few to many stems arising from base. Stems sparingly to much branched, ascending to erect, up to 4 mm across; young branchlets smooth, pale green or purplish green. Leaves petiolate, mostly alternate or subopposite or subwhorled distally on branchlets; stipules subtriangular, 0.9–1.5 mm long, with apex acuminate and margins with irregular gland-tipped lobes, pale yellow to white; petiole 1–5 mm long, concavo-convex in transverse section; laminae ovate or narrowly obovate to obovate, (6–)10–35 mm long, (1.5–)2–15 mm wide, with base attenuate and apex acute to obtuse and minutely apiculate, flat, with margins entire or coarsely toothed distally with obtuse-tipped teeth, smooth adaxially and abaxially, discolorous, chartaceous and smooth when dried; midrib slightly impressed adaxially, prominent abaxially. Inflorescence sessile or pedunculate when peduncles stout, up to 25 mm long and 0.5–0.8 mm across; bracts numerous; outer bracts ovate, c. 0.8 mm long, with margins entire, yellow. Male flowers 3–14 per cyme; pedicels 1.5–3.5 mm long; calyx lobes ovate, ovate-elliptic or elliptic, 1.2–1.7 mm long, 0.7–1.1 mm wide, with apex acute and margins entire, keeled distally, yellow; petals reniform, 0.5–1.1 mm long including claw, 0.8–1.3 mm wide, with base

deeply cordate, apex rounded but sometimes notched and margins entire or undulate, white; glands 0.2–0.3 mm long, glabrous; staminal filaments 1.1-1.7 mm long; anthers 0.2–0.3 mm long; connective tissue 0.1–0.2 mm long; rudimentary ovary absent. Female flowers 1 or 2 per cyme, sessile; calyx lobes ovate to broadly ovate, 1–1.3 mm long, 0.7–0.9 mm wide, with apex acute and margins entire, concavo-convex, yellow; petals absent; glands 3–5, 0.3–0.4 mm long; ovary trigonal-globose, c. 1.7 mm across and 1.4 mm long; styles 0.9–1.2 mm long, 2-lobed; lobes c. half the length of style. Capsule ovoid, 3–4 mm long, 2.9–3 mm across, smooth. Seeds obloid, 1.8–2 mm long, 1.2–1.3 mm wide, 0.9–1 mm deep; testa smooth, brown to black; caruncle hemispherical, 0.3–0.6 mm long, 0.6–0.7 mm across, white or pale red. Fig. 2.

***Selected specimens (from 56 examined)*: Queensland.** Mitchell District: near Red Gorge, White Mountains National Park, Jun 1992, *Bean* 4579 (BRI); 41 km N of Torrens Creek, May 1993, *Thompson & Turpin* HUG260 (BRI). Leichhardt District: Mt Zamia EP, just W of Springsure, Nov 1993, *Bean* 6912 (BRI). Port Curtis District: Amos road, N of Mullet Creek, NW of Bundaberg, Aug 1996, *Bean* 10542 (BRI, NSW). Burnett District: Abbeywood, NNE of Proston, May 1996, *Bean* 10281 (BRI); 2.5 km W of "Toondahra" Homestead, base of Mt Lorna, Sep 1985, *Forster* PIF2225 (BRI). Wide Bay District: Mt Tinbeerwah, c. 5 miles (8 km) W of Tewantin, Jan 1970, *Henderson* H538 (BRI); 2 km SE of Woodgate, Nov 1993, *Bean* 7040 (BRI, NSW); Kinkuna National Park, SE of Bundaberg on southern boundary of park, Apr 1994, *Brushe* JB770 (BRI); Mt Walsh summit, Mt Walsh National Park, Aug 1996, *Forster* PIF19547 *et al.* (BRI); Elliott River, on main road S of Bundaberg, Jul 1958, *Gittins* (BRI); Mt Tinbeerwah, about 6 km W of Tewantin, Jan 1989, *Sharpe* 4841 (BRI); Mt Tinbeerwah, May 1969, *Smith* (BRI). Darling Downs District: 1.6 miles (C.2.6km) S of Miles, Mar 1994, *Bean* 7578 (BRI, MEL); Miles, Jun 1946, *Webb* 1160 & *White* (BRI). Moreton District: Canungra Army Reserve, Sep 1994, *Forster* PIF15777 (BRI, NSW). **New South Wales.** Hermitage Plains, Cobar District, Jul 1903, *Bauerlen* (NSW); c. 0.9 km SE of the confluence of Burra Creek and Oulla Creek, Jan 1991, *Albrecht* 4698 & *Westaway* (MEL); Deua National Park, Burra Creek, 1.5 km due ESE of the confluence of Burra and Coondella Creeks, Jan 1993, *Albrecht* 5307 (MEL).

***Distribution and habitat*:** In Queensland, *M. macrophylla* occurs from near Rockhampton southwards to the McPherson Range, with isolated populations near Hughenden and Springsure. *M. macrophylla* also occurs in isolated occurrences in New South Wales from Howell, Cobar and Batemans Bay districts (Map 3). In coastal areas, it is recorded as growing in heathland, *Banksia* woodland and open *Eucalyptus* forest communities, on deep white sandy soils. In subcoastal and inland areas, it is recorded as growing in heathland and *Eucalyptus* woodland and open forest communities, on shallow sandy or red loam soils, on stony ridges, rocky mountain slopes, and sandstone gorges and plateaux. It is also recorded as growing in areas subject to disturbance such as cultivation and along firebreaks.

***Phenology*:** Flowers and fruits have been collected throughout the year.

***Notes*:** *Monotaxis macrophylla* is closely related to *M. luteiflora* and *M. tenuis*. It differs from *M. luteiflora* in its longer staminal filaments (1.9–2.5 mm long as compared with 1.0–1.8 mm long) and obloid rather than ellipsoid seeds. *M. macrophylla* generally has green leaves, although sometimes with a purplish tinge, while *M. luteiflora* has yellowish green leaves. *Monotaxis macrophylla* differs from *M. tenuis* in its robust habit, fleshier leaves, entire or obtuse-toothed rather than acute-toothed leaves and stouter peduncles (0.5–0.8 mm across as compared with 0.2–0.3 mm across).

There is considerable variation in the size of the leaves and degree of division of the leaf margins of this species as circumscribed here. The collections *Henderson* H538 (BRI) from the Wide Bay District, *Bean* 7578 (BRI) and *Webb* 1160 & *White* (BRI) from the Darling Downs District and *Thompson & Turpin* HUG260 (BRI) from the Mitchell District all have comparatively very small entire leaves (6–10 mm long, 1.5–2.0 mm wide) and the stems are much more intricately branched than are those in other variants of this species. However, these variations tend to intergrade and are not considered worthy of formal recognition.

4. Monotaxis luteiflora F.Muell., Fragm. 10: 51/ 52 (1876). **Type:** (Western Australia.) Victoria Spring, (in 1875,) *J. Young* (lecto, here chosen: MEL [MEL2065966]).

***Illustrations*:** G. Grüning (1913: 80, fig. 13 E); A. Kalotas (1981: 191, fig. 217); J.Z. Weber (1986: 758, fig. 405).

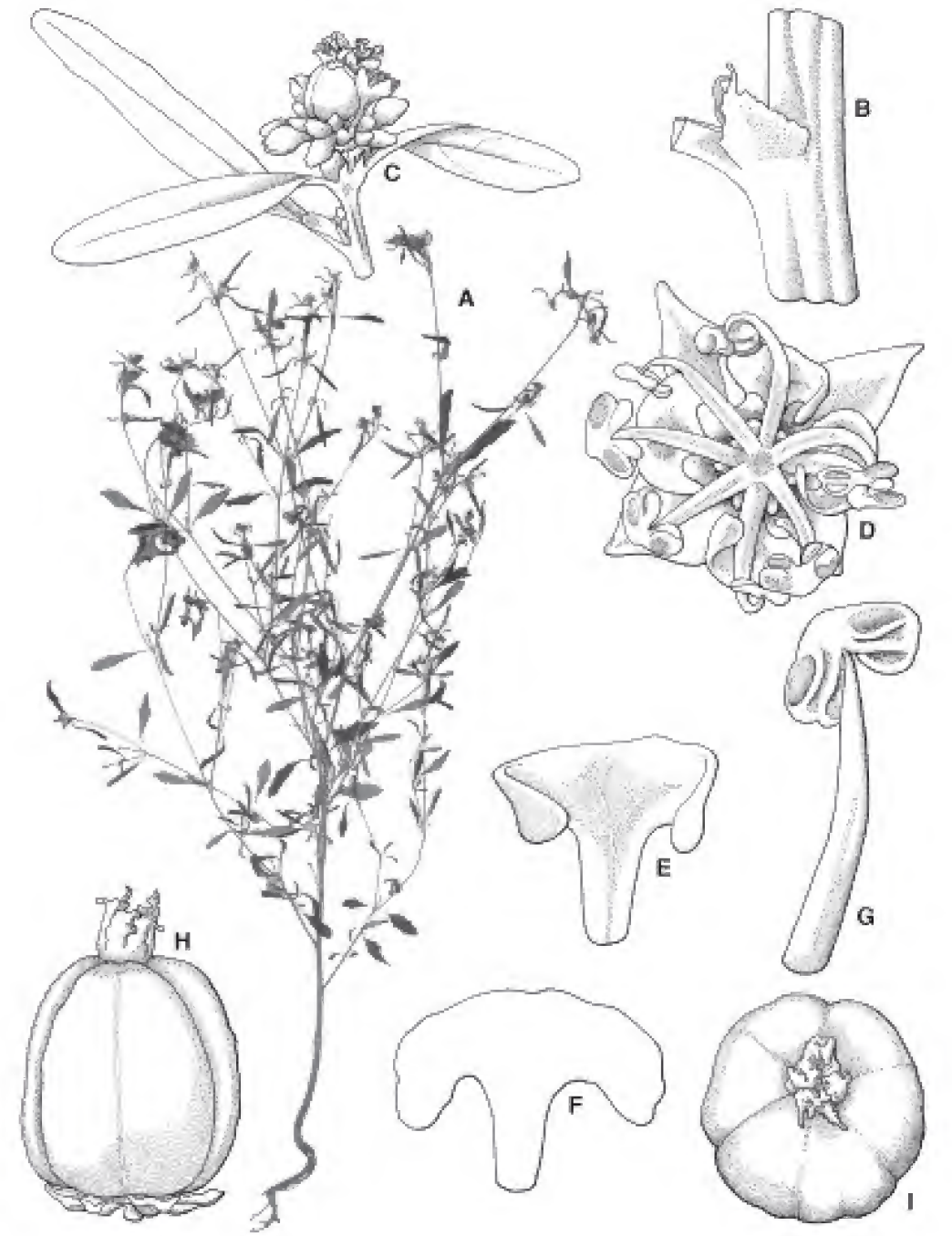


Fig. 2. ***Monotaxis macrophylla*.** A. habit. ×0.4. B. section of branchlet with stipule and leaf. ×16. C. flowering branchlet. ×4. D. male flower. ×16. E. adaxial view of petal of male flower. ×30. F. adaxial view of petal of male flower, flattened out. ×30. G. abaxial view of antipetalous stamen. ×30. H. fruit from side. ×12. I. fruit from above. ×12. A from *Smith* [AQ316165] (BRI); B, C from *Bean* 10542 (BRI); D–G from *Henderson* H3206 (BRI); H, I from *Francis* [AQ204098] (BRI). Del. W. Smith.

Glabrous, monoecious, fruticose annuals or possibly short-lived herbaceous perennials to 60 cm high, with few to many stems arising from the base. Stems sparingly to much-branched, ascending to erect or sometimes decumbent, up to 4 mm across; young branchlets smooth, their colour when fresh unknown. Leaves petiolate, alternate or subopposite or subwhorled distally on branchlets; stipules triangular, 1.5–2.5 mm long, with apex acute to acuminate and margins with irregular, gland-tipped lobes, pale yellow; petiole 2–15 mm long, concavo-convex in transverse section; laminae narrowly elliptic to elliptic, narrowly ovate or narrowly obovate, 15–50 mm long, 3–14 mm wide, with base attenuate and apex obtuse, flat, with margins entire or coarsely toothed distally with obtuse-tipped teeth, smooth adaxially and abaxially, discolorous, crustaceous and somewhat wrinkled when dried; midrib impressed adaxially, prominent abaxially. Inflorescence sessile or pedunculate when peduncles stout, 3–30 mm long, 0.7–0.9 mm across; bracts numerous; outer bracts broadly ovate, 1.4–2 mm long, with margins entire, yellow. Male flowers 3–22 per cyme; pedicels 2.2–5 mm long; calyx lobes narrowly ovate or ovate-elliptic, 1.9–2.4 mm long, 1–1.2 mm wide, with apex acute and margins entire, slightly keeled distally, yellow; petals reniform, 0.8–1.3 mm long including claw, 1.4–1.8 mm wide, with base deeply cordate, apex rounded and notched and margins entire, white or yellow; glands 0.1–0.2 mm long, glabrous; staminal filaments 1.9–2.5 mm long; anthers 0.2–0.3 mm long; connective tissue 0.1–0.2 mm long; rudimentary ovary absent. Female flowers 1–3(–6) per cyme, subsessile; calyx lobes broadly ovate or suborbicular, 1.2–1.8 mm long, 1.2–1.8 mm wide, with apex obtuse and margins entire or undulate, flat, yellow; petals absent or rarely present as minute rudimentary lobes; glands 5, up to 0.4 mm long; ovary trigonal-globose, 1.1–1.6 mm across and 1.3–1.6 mm long; styles 1–1.5 mm long, 2-lobed; lobes c. half the length of style. Capsule subglobose, 2.7–3.2 mm long, 2.7–3 mm across, smooth. Seeds ellipsoid, slightly dorsi-ventrally flattened, 1.8–1.9 mm long, 1.4–1.5 mm wide, 1.1–1.4 mm deep; testa smooth, brown; caruncle hemispherical, 0.4–0.6 mm long, 0.5–0.7 mm across, white or pale red.

***Selected specimens (from 42 examined)*: Western Australia.** 36 miles (c. 58 km) N of Wiluna, Sep 1973, *Beard* 6557 (NSW, PERTH); 5 km N of Gary Junction-Well 35 track along Billiluna track, May 1979, *George* 15659 (CANB, PERTH); No 16 Well, Canning Stock Route, May 1968, *de Graaf* 174 (PERTH); 70 km E of Calvert Range, Jun 1984, *Morse* 212 (CANB, PERTH); 40 km NE of Earaheedy HS (Homestead), Sep 1979, *Toelken* 6265 (MEL); 76 miles (c.122 km) N of Sandstone, Jul 1963, *George* 5649 (PERTH); c. 45 km E of Milbillillia Homestead on Barwidgee road, May 1978, *Craven* 5371 (CANB); 30 miles (c. 48 km) N of Wiluna, Sep 1957, *Speck* 832 (CANB, PERTH); 62 miles (c. 100 km) N of Agnew on road to Wiluna, Aug 1963, *Aplin* 2398 (MEL, PERTH); 48 km N of Leonora, Sep 1939, *Blackall* 4118 (PERTH); Comet Vale, Sep 1927, *Gardner* 2157 (PERTH); c. 35 km W of Plumridge Lakes, 8.5 km WNW of Salt Creek airstrip, Sep 1979, *Crisp* 5834 *et al.* (CANB); Officer Basin, Nov 1986, *Pearson* 130 (PERTH); 9 miles (c.14 km) W of Coolgardie, Sep 1962, *Phillips* [CBG038821] (CANB); 5.2 km W of Zanthus, Oct 1986, *Keighery & Alford* 908 (PERTH); Panton (Ponton) Creek, 144 miles (c. 232 km) E of Kalgoorlie, Jun 1974, *Aplin* 5718 & *Trudgen* (CANB, PERTH). **Northern Territory.** Hasst Bluff Station, Dec 1977, *Latz* 7515 (BRI); Talipata East, W of Haast Bluff, Dec 1977, *Latz* 7533 (BRI). **South Australia.** 2 km NW (of) Victory Well, The Everard Ranges, May 1991, *Latz* 11890 (AD); Mount Illbillee, The Everard Ranges, Sep 1968, *Spooner* 121 (AD).

***Distribution and habitat*:** *Monotaxis luteiflora* is confined to the central and southern inland areas of Western Australia from the Great Sandy Desert southwards to Zanthus, with disjunct populations in southern Northern Territory on Haast Bluff Station and in The Everard Ranges in the Far North West district of South Australia (Map 4). It is recorded as growing in *Triodia* grassland, shrub steppe and mallee communities, on red sandy soils, on plains and dunefields, and was frequently noted to occur in areas regenerating after fire (*Speck* 832 (CANB, PERTH), *Latz* 7522 (BRI), *Beard* 6557 (NSW, PERTH), *Latz* 11890 (AD)). At Haast Bluff, *M. luteiflora* has been collected from along a small watercourse and the upper slopes of quartzite hills.

***Phenology*:** Flowers and fruits have been collected from May to November, with occasional collections from February and March.

***Typification*:** Mueller (1876) cited two collections in the protologue of *M. luteiflora*, viz. "Ad Victoria-Spring et Ularing: Young". We have located three sheets that are relevant, viz. East of Ularing, 10-15 Oct 1875, *Young* [MEL2065961] (MEL); Victoria Springs, *Young* [MEL2065966](MEL); East of Ularing,

1875, *Young* (K). The sheet MEL2065966 at MEL is here chosen as the lectotype of the name *M. luteiflora* because it is the most complete of the three having both leaves and flowers still attached to the branchlets.

***Notes*:** *Monotaxis luteiflora* is most closely related to *M. macrophylla* and *M. tenuis*. It differs from *M. macrophylla* in its shorter staminal filaments (1.0–1.8 mm long as compared with 1.9–2.5 mm long) and ellipsoid rather than obloid seeds. *M.luteiflora* has generally yellowish green leaves while *M. macrophylla* has mostly green leaves. *Monotaxis luteiflora* differs from *M. tenuis* by its robust habit, more fleshy leaves, entire or obtuse-toothed rather than acute-toothed leaves and stouter peduncles (0.7–0.9 mm across as compared with 0.2–0.3 mm across).

5. Monotaxis tenuis Airy Shaw, Muelleria 4: 239 (1980). **Type:** Northern Territory. 41 miles (c. 65 km) NE of Pine Creek, 25 Jul 1971, *M.M.J. van Balgooy & N. Byrnes* 1358 (holo: K; iso: CANB).

Glabrous, monoecious, diffuse annuals to 60 cm high, with a single stem at the base. Stems sparingly to much branched, ascending to erect, up to 5 mm across; young branchlets smooth, pale green to greenish yellow. Leaves petiolate, alternate or subopposite or subwhorled distally on branchlets; stipules triangular, 0.8–1.5 mm long, with apex acuminate and margins with irregular, gland-tipped lobes, white to pale yellow; petiole 2–17 mm long, concavo-convex in transverse section; laminae narrowly ovate, narrowly obovate or narrowly elliptic, 12–50 mm long, 4–13 mm wide, with base attenuate to cuneate and apex acute to obtuse, flat with margins coarsely toothed with acute-tipped teeth, smooth adaxially and abaxially, discolorous, chartaceous when dried; midrib impressed adaxially, prominent abaxially. Inflorescence sessile or pedunculate with peduncles slender, up to 40 mm long and 0.2–0.3 mm across; bracts numerous; outer bracts ovate to broadly ovate, 1–1.2 mm long, with margins entire or toothed, greenish yellow. Male flowers 3–11 per cyme; pedicels 1.3–2 mm long; calyx lobes ovate-elliptic, 0.9–1.5 mm long, 0.5–0.9 mm wide, with apex acute and margins entire, slightly keeled distally, greenish yellow or white; petals reniform, 0.6–0.9 mm long including claw, c. 1 mm wide, with base deeply cordate, apex rounded and margins entire, white or pale yellow; glands c. 0.1 mm long, glabrous; staminal filaments 1.1–1.5 mm long; anthers 0.1–0.2 mm long; connective tissue up to 0.1 mm long; rudimentary ovary absent. Female flowers 1 or 2 per cyme, sessile or shortly pedicellate when pedicels c. 0.1 mm long; calyx lobes narrowly ovate to ovate, 1.1–1.7 mm long, 0.5–1 mm wide, with apex acute and margins ± entire, concavo-convex, greenish yellow; petals absent; glands up to 5, 0.3–0.6 mm long; ovary trigonal-ellipsoid, 1.4–1.6 mm across and 1.5–2.1 mm long; styles 1–1.4 mm long, 2-lobed; lobes c. two-thirds the length of style. Capsule ellipsoid, 3–3.5 mm long, 2.5–2.7 mm across, ± smooth. Seeds obloid to ellipsoid, slightly dorsi-ventrally flattened, 1.8–2.1 mm long, 1.2–1.4 mm wide, 0.8–1 mm deep; testa smooth, brown; caruncle sagittate in outline, c. 0.5 mm long, c. 0.6 mm across, pinkish white.

***Selected specimens (from 19 examined)*:** **Western Australia.** Mitchell River, Feb 1980, *Dunlop* 5290 (PERTH). **Northern Territory.** Mt Brockman, Feb 1977, *Barnett & Azzoardi* 49 (CANB); Kakadu National Park, Upper Gimbat Creek, Apr 1990, *Cowie* 1154 & *Leach* (MEL); 23.5 km WSW of Twin Falls, May 1980, *Craven* 6206 (CANB, MEL); 1 km S of Twin Falls, May 1980, *Craven* 5805 (CANB); Kakadu National Park, Apr 1990, *Dunlop* 8569 & *Munns* (BRI); Deaf Adder Gorge, Feb 1977, *Dunlop* 4433 (CANB, NSW); East Alligator River area, Mar 1973, *Dunlop* 3423 (BRI); Ikoymarrwa Lookout, 70 km NE of Pine Creek, Kakadu National Park, Apr 1992, *Halford* Q1163 (BRI); Baroalba Springs, Kubarra, Kakadu National Park, Apr 1992, *Halford* Q1106 (BRI); Mt Brockman Outlier, 15 km SE of Jabiru, Apr 1989, *Johnson* 4800 (BRI); c. 31 miles (50 km) ENE of Mudginbarry HS (Homestead), Feb 1973, *Lazarides* 7774 (BRI, NSW); 15.5 km SW of Twin Falls, May 1980, *Lazarides* 9113 (CANB); 2-3 miles (c. 3-5 km) N (of) El Sharana, Jan 1973, *Martensz & Schodde* AE561 (CANB); UDP Falls, near El Sharana, Jan 1973, *McKean* B866 (BRI, CANB).

***Distribution and habitat*:** *Monotaxis tenuis* occurs in the Mitchell River area of the Kimberley region, Western Australia, and in Kakadu National Park, Northern Territory (Map 5). It is recorded from seasonally moist sandy habitats on sandstone outcrops.

***Phenology*:** Flowers and fruits have been collected from January to April.

***Notes*:** Airy Shaw (1980) recorded *Monotaxis tenuis* as occurring in south-east Queensland, based on a collection by C.T. White from near Canungra (*White* 11051). Examination of BRI holdings of this collection shows it to be *M. macrophylla*.

Monotaxis tenuis is most closely related to *M. macrophylla* and *M. luteiflora*. It differs from both these species by its slender habit, thinner textured, acute-toothed (as opposed to entire or obtuse-toothed) leaves and slender peduncles 0.2–0.3 mm (as compared with 0.4–0.9 mm) across.

Monotaxis sect. **Hippocrepandra** (Müll.Arg.) Baill., Adansonia 6: 291 (1866). **Type:** *M. gracilis* (Müll.Arg.) Baill. (= *M. bracteata* Nees)

Monoecious or dioecious, herbaceous perennials; stems filled internally with spongy parenchyma tissue. Leaves crowded with internodes 1–20 mm long; laminae with margins entire, mostly revolute. Inflorescences sessile. Male flowers 5-merous; calyx imbricate, without glands on abaxial surface; petals present, longer than calyx lobes; antisepalous glands with terminal tuft of simple hairs; stamens 10(rarely 11); connective slender; rudimentary ovary present. Female flowers 5(rarely 6)-merous; calyx imbricate, without glands on abaxial surface; petals present, longer than calyx lobes; styles slender, with numerous linear lobes abaxially.

***Distribution*:** The species of *Monotaxis* sect. *Hippocrepandra* are confined to south-western Western Australia.

6. Monotaxis bracteata Nees in Lehm., Pl. Preiss. 2: 230 (1848); *Hippocrepandra neesiana* Müll.Arg., Linnaea 34: 62 (1865), *nom. illeg.*; *Monotaxis neesiana* Baill., Adansonia 6: 293 (1866), *nom. illeg.* **Type:** (Western Australia.) York, 12 Sept 1839, *L. Preiss* 1219 (holo: LD; iso: G-DC *n.v.*, microfiche IDC 800-73. 2455: III. 5, MEL [MEL2065970, MEL2062922 (ex herb. Sonder)]).

Monotaxis megacarpa F.Muell., Fragm. 4: 143 (1864). **Type:** (Western Australia.) Murchinson River, (without date,) *A.F. Oldfield* (lecto, here chosen: MEL [MEL2065964]; isolecto: K (ex herb. Hook.); MEL [MEL2065963]).

Hippocrepandra gracilis Müll.Arg., Linnaea 34: 62 (1865); *Monotaxis gracilis* (Müll.Arg.) Baill., Adansonia 6: 293 (1866); *Monotaxis gracilis* Müll.Arg. var. *gracilis*, Grüning in A. Engler, Pflanzenr. H.58: 83/84 (1913). **Type citation:** (Western Australia.) "Ad Swan River (*Drummond* ser.3. n.18)" (holo: G-DC *n.v.*, microfiche IDC 800–73. 2455: III. 4; iso: K (2 sheets), PERTH).

Hippocrepandra lurida Müll.Arg., Linnaea 34: 61/ 62 (1865); *Monotaxis lurida* (Müll.Arg.) Benth., Fl. Austral. 6: 80 (1873). **Type:** (Western Australia.) Swan River, (without date,) *J. Drummond* ser.6. n.87 (holo: G-DC *n.v.*, microfiche IDC 800–73. 2455: III. 3; iso: K; MEL [MEL2065967]).

Monotaxis oldfieldii Baill., Adansonia 6: 293 (1866). **Type:** (Western Australia.) Murchison river, (without date,) *A.F. Oldfield* (holo: MEL [MEL2065962]; iso: K, MEL [MEL2065968]).

Monotaxis gracilis var. *virgata* Grüning in A. Engler, Pflanzenr. H.58: 83/84 (1913). **Type:** Western Australia. Watheroo Rabbit Fence, Sep 1905, *M. Koch* 1457 (syn: ? *n.v.*; isosyn: K (2 sheets), MEL [MEL2065960], NSW, PERTH); Western Australia. Victoria, Greenough River Crossing, (without date,) *Diels* 3297a (syn: ? *n.v.*).

Monotaxis stowardii S.Moore, J. Linn. Soc., Bot, 45: 192/193 (1920). **Type:** Western Australia. Traying, in 1917, *F. Stoward* 292 (holo: BM *n.v.* (transparenies at BRI); iso: MEL [MEL2065965]).

Monotaxis gracilis var. *genuina* Grüning in A.Engler, Pflanzenr. H.58: 84 (1913), *nom. inval.*

***Illustration*:** G. Grüning (1913: 83, fig.14 A), as *M. gracilis* var. *virgata.*

Glabrous, monoecious or sometimes apparently dioecious, compact herbaceous perennials to 50 cm high, with few to many stems arising from a single rootstock. Stems sparingly to much branched, ascending to erect, up to 4 mm across; bark spongy, fissured, dull greyish white; young branchlets smooth or papillose, reddish brown. Leaves petiolate or subsessile, alternate; stipules narrowly triangular to subulate, 0.3–2 mm long, erect, mostly entire or sometimes unequally 2(to 4)-fid, red-brown; petiole up to 0.8 mm long, plano-convex in transverse section; laminae lanceolate, narrowly ovate, narrowly elliptic, narrowly oblong-elliptic or lorate, (5–)8–30 mm long, (0.6–)3–6 mm wide, with base obtuse or cuneate and apex acute to obtuse with short apiculum, ± flat with margins entire and recurved to revolute, smooth adaxially and abaxially, discolorous, crustaceous and dull green to brown when dried; midrib obscure or slightly impressed adaxially, prominent abaxially. Inflorescence sessile; bracts numerous; outer bracts ovate, up to 2.5 mm long, with margins toothed, reddish brown. Male flowers 6–9 per cyme; pedicels 2–3.3 mm long; calyx lobes ovate, 1–1.8 mm long, 0.7–1.2 mm wide, with apex acute to obtuse and margins erose, ± flat, dark red or yellowish green with margins red; petals ovate or oblong, 2.1–4.1 mm long including claw, 1.3–2.3 mm wide, with base cordate or auriculate, apex obtuse to rounded or acute and margins entire or erose, white or yellowish white; glands 0.3–0.8 mm long, with terminal tuft of hairs 0.4–1.4 mm long; staminal filaments 1.7–3.1 mm long; anthers 0.3–0.4 mm long; connective tissue 0.2–0.9 mm long; rudimentary ovary present, with 3–5 erect linear lobes; lobes 1.2–2.7 mm long. Female flowers 1–4 per cyme, pedicellate; pedicels 2–3.2 mm long; calyx lobes ovate, 1.6–2.8 mm long, 0.9–1.3 mm wide, with apex acute or shortly acuminate and margins erose, ± flat, green with a reddish blush on margins; petals ovate or elliptic, 2.5–3.8 mm long including claw, 1.5–2.4 mm wide, with base truncate or cuneate, apex acute or obtuse to rounded and margins erose, ± flat, white or yellowish white; glands 7–10, 0.4–0.5 mm long, glabrous; ovary trigonal-globose, 1.1–2.8 mm across and 1.1–2.2 mm long; styles 1.5–2.3 mm long, 2-lobed; lobes two-thirds to three-quarters the length of style. Capsule subglobose, 3.5–4.5 mm long, 3–4.5 mm across, ± smooth. Seeds ellipsoid, ovoid or obloid, slightly dorsi-ventrally flattened, 1.8–2.5 mm long, 1.1–1.5 mm wide, 1.1–1.5 mm deep; testa slightly rugose or smooth, grey or reddish-brown; caruncle sagittate in outline, 0.7–0.9 mm long, 0.6–0.8 mm across, yellowish white. Fig. 3.

***Selected specimens (from 100 examined)*: Western Australia.** Kalbarri National Park, c. 6 km along the track to the Z-bend from the intersection with the Ajana-Kalbarri Road, Sep 1990, *Albrecht* 4217 & *Fuhrer* (MEL); 3 miles (c. 5 km) N of Drummonds Crossing on Eneabba-Dongara Highway, Nov 1974, *Beard* 7277 (PERTH); Ajana, Aug 1980, *Bellairs* 1383 (PERTH); between Northampton and Geraldton, Sep 1932, *Blackall* 2734 (PERTH); Pindar, Sep 1931, *Blackall* 656 (PERTH); South Arrowsmith River, Sep 1969, *Burns* 113 (PERTH); 17.1 miles (c. 27.5 km) from Wubin towards Wongan Hills, Sep 1968, *Canning* (BRI, CANB); 6 km NNW of Mount Muggawa, Sep 1990, *Cranfield* 7873 & *Spencer* (CANB); South Eneabba road, Jul 1980, *Cranfield* 1476 (CANB, PERTH); 15 km NW of Jitarning, Oct 1983, *Cranfield* 4745 (PERTH); Murchinson House Station, Shark Bay track, 23 km N of river, Oct 1993, *Craven* 8930 *et al.* (CANB, MEL); 5 km S of Kalbarri airstrip, Oct 1979, *Crisp* 6302 *et al.* (CANB); c. 9 km NE of Perenjori, on road to Morawa , Sep 1988, *Henderson* H3152 (BRI); c. 11 km NW of Three Springs, on The Midlands Road to Mingenew, Sep 1988, *Henderson* H3142 (BRI); SE foothills of Mt Caroline, c. 19 km SSW of Kellerberrin, Sep 1988, *Henderson* H3159 (BRI); St Ronans Nature Reserve, 17 km W of York, Nov 1985, *Keighery & Alford* 381 (PERTH); 30 miles (c. 48 km) E of Geraldton, Apr 1960, *Long* 46 (PERTH); 24 miles (c. 39 km) from Dongara towards Eneabba, Sep 1968, *Phillips* (CANB, MEL); 25 km from North West Coastal Highway along road to Kalbarri, Sep 1983, *Purdie* 5202 (CANB); 6 miles (c. 10 km) NW of Three Springs, Geraldton Highway, Sep 1966, *Smith* 66/249 (CANB, MEL, PERTH).

***Distribution and habitat*:** *Monotaxis bracteata* is confined to the south-west of Western Australia, from Kalbarri south-east to Jitarning (Map 6). It is recorded as growing in sandplain heath, shrubland and eucalypt woodland communities, on deep sandy soils or sandy to sandy loam soils sometimes with lateritic gravel in the soil profile or over laterite, on sandplains and low undulating country. It is also recorded from granitic soils on Mt Stirling and near Wubin.

***Phenology*:** Flowers have been collected from April to November, fruits from August to December.

***Typification*:** Mueller (1864) cited "Ad flumen Murchison River, Oldfield" in the protologue of *Monotaxis megacarpa*. Three relevant



Fig. 3. ***Monotaxis bracteata***. A. habit. ×0.4. B. section of branchlet with stipule. ×16. C. flowering branchlet. ×4. D. male flower. ×8. E. adaxial view of petal of male flower. ×12. F. adaxial view of petal of male flower, flattened out. ×12. G. abaxial view of antisepalous stamen. ×16. H. abaxial view of antipetalous stamen. ×16. I. fruit from side. ×8. J. fruit from above. ×8. A, C–J from *Henderson* H3142 (BRI); B from *Canning* [AQ204085] (BRI). Del. W. Smith.

specimens have been located, two at MEL (MEL2065964 and MEL2065963) and one at K. All three are labelled *M. megacarpa*. The two MEL sheets have been labelled *M. megacarpa* in what we believe to be Mueller's hand. The MEL sheet MEL2065964 is here chosen as the lectotype of Mueller's name *M. megacarpa*.

***Notes*:** Bentham (1873) and Grüning (1913) placed the name *M. bracteata* Nees in synonymy under *M. grandiflora* Endl. As noted by Bentham, the type material of *M. bracteata* (*Preiss* 1219) is lacking leaves along the main stems, but it has a few leaves attached to the shorter lateral branchlets. However, after close examination of specimens of *Preiss* 1219 held at LD and MEL, it is clear that *M. bracteata* does not apply to the species named *M. grandiflora*. The young branchlets of *Preiss* 1219 are clearly papillose, a character state that has not been observed by us in material referred to *M. grandiflora*. Since it is conspecific with the species here circumscribed, the name *M. bracteata*, being the earliest legitimate name available for it, is thus the correct name to apply to this taxon.

As circumscribed here, *M. bracteata* is morphologically variable. There is considerable variation in the general aspect of plants, leaf and stem thickness, degree of stem branching and the degree of curvature of the leaf lamina margins. The majority of names placed in synonymy of *M. bracteata* Nees are applicable to one of two common forms of the plant. *M. megacarpa* F.Muell., *M. gracilis* (Müell Arg.) Baill. and *M. stowardii* S.Moore apply to slender stemmed, thin leaved and regularly branched forms, while the names *M. lurida* (Müell.Arg.) Benth. and *M. oldfieldi* Baill. apply to more robust stemmed, thick leaved and generally less-branched forms.

7. Monotaxis grandiflora Endl., Enum. pl. 19/20 (1837). **Type:** (Western Australia.) King George Sound, (without date,) *K.A.A.F. Hügel* (holo: W *n.v.* (transparencies at BRI)).

Glabrous, monoecious or dioecious, compact to diffuse herbaceous perennials to 30 cm high, with few to many stems arising from a single rootstock. Stems sparingly to much branched, ascending to erect, up to 4 mm across; bark spongy, ± smooth or fissured, dull yellowish brown; young branchlets ± smooth or slightly striate when dried, reddish brown. Leaves petiolate or subsessile, alternate or subopposite directly below inflorescences; stipules subulate, (0.6–)1–3 mm long, erect, with apex entire or unequally bifid with secondary lobes up to 1.5 mm long, twisted and usually reflexed, red-brown; petiole up to 0.7 mm long, plano-convex in transverse section; laminae linear, lorate or lanceolate, 2–20 mm long, 0.6–1.2(–1.6) mm wide, with base cuneate and apex acute with prominent apiculum up to 0.4 mm long or obtuse, with margins entire, strongly revolute to midrib, smooth adaxially, smooth or papillate abaxially, crustaceous and grey-white when dried; midrib obscure adaxially, prominent abaxially. Inflorescence sessile; bracts numerous; outer bracts ± oblong, up to 1.5 mm long, with margins toothed distally, reddish brown. Male flowers 2–15 per cyme; pedicels 2.6–5.4 mm long; calyx lobes ovate or ovate-elliptic, 0.7–2.2 mm long, 0.5–0.9 mm wide, with apex acute or shortly acuminate and margins ± entire, ± flat, pale green with pink or pink-orange margins; petals ovate or oblong, 2.0–2.6 mm long including claw, 1.0–1.6 mm wide, with base cordate or auriculate, apex rounded or obtuse with a minute apiculum and margins entire or erose, pink, creamy white or pale yellow; glands 0.1–0.4 mm long, with a terminal tuft of hairs up to 0.2 mm long; staminal filaments 1.3–2.1 mm long; anthers 0.2–0.3 mm long; connective tissue 0.2–0.5 mm long; rudimentary ovary present, with 3–5 erect linear lobes 1.3–1.7 mm long. Female flowers 1–5 per cyme, pedicellate; pedicels 0.8–2 mm long; calyx lobes ovate to broadly ovate, 1.1–2.9 mm long, 0.4–1.2 mm wide, with apex acute to shortly acuminate and margins entire or erose, ± flat, pale green with pink or pink-orange margins; petals ovate or elliptic, 2.2–3.4 mm long, 1.3–1.6 mm wide, with base cuneate, apex acute to obtuse and sometimes shortly apiculate and margins entire or erose, ± flat, pink, creamy white or pale yellow; glands 5, 0.2–0.5 mm long, glabrous; ovary trigonal-globose, 1.1–1.6 mm across and 1.1–1.6 mm long; styles 1.2–1.8 mm long, 2-lobed; lobes c. four-fifths the length of the style. Capsule subglobose, 2–3 mm long, 2–3 mm across, ± smooth. Seeds ovoid to globose or

ellipsoid, slightly dorsi-ventrally flattened, 1.2–1.8 mm long, 0.9–1.4 mm wide, 0.8–1.1 mm deep; testa smooth, brown to dark brown; caruncle reniform to sagitate in outline, 0.7–0.9 mm long, 0.6 mm across, yellowish white.

***Distribution*:** *Monotaxis grandiflora* is confined to the south-west of Western Australia, in an area approximately bounded by Dongara, Perth, Stirling Ranges, Esperance, Widgiemooltha and Wubin (Maps 7 & 8).

***Notes*:** *Monotaxis grandiflora* differs from *M. bracteata* in having generally narrower leaf laminae with the margins revolute to the midrib so that only the midrib is visible on the abaxial surface, and having a greyish white appearance when dried, as well as branchlets which are smooth and never papillose.

Variability within this species warrants two varieties being recognised. They can be distinguished using the following key.

1. Leaf apex apiculate **7a. M. grandiflora** var. **grandiflora**
 Leaves apex obtuse or acute **7b. M. grandiflora** var. **obtusifolia**

7a. **Monotaxis grandiflora** Endl. var. **grandiflora**

Monotaxis ericoides Klotzsch in Lehm., Pl. Preiss. 1: 177 (1845); *Hippocrepandra ericoides* (Klotszch) Müll.Arg., Linnaea 34: 62 (1865) *nom. reject.* **Type:** Western Australia. Perth, 19 Sep 1839, *L. Preiss* 1218 (holo: LD; iso: B (Herb. L.C.Treviranus acc.1936), G-DC *n.v.*, microfiche IDC 800-73. 2455: I. 6 (top element), MEL [MEL2062925 (ex herb. Sonder), MEL2062923 (ex herb. Sonder), MEL2066088]).

Monotaxis grandiflora var. *typica* Grüning in A. Engler, Pflanzenr. H.58: 85 (1913), *nom. inval.*

Perennials to 30 cm high. Leaves with petiole 0.5–0.7 mm long; laminae linear to lanceolate, 4–20 mm long, 0.6–1.2(–1.6) mm wide, the apex acute with a prominent apiculum up to 0.4 mm long. Male flowers with calyx lobes ovate or ovate-elliptic, 1.1–2.2 mm long and acute or shortly acuminate, and with petals ovate or oblong, 2.2–2.6 mm long. Female flowers with calyx lobes ovate and 2.0–2.9 mm long with petals ovate, 2.5–3.4 mm long.

***Selected specimens (from 61 examined)*: Western Australia.** Mt Desmond, near Ravensthorpe, Oct 1963, *Aplin* 2691 (MEL, PERTH); S of Dongara, Eneabba road, Sep 1969, *Ashby* 3014 (PERTH); c. 8 miles (13 km) S of Jerramungup-Ravensthorpe road, along No.2 Rabbit Fence, toward Twertup Quarry, Nov 1968, *Canning* WA/68 7508 (CANB); 2 km S of Cockleshell Gully on Jurien Bay road, Sep 1982, *Corrick* 8041 (MEL, PERTH); Jarrah Road, South Perth, Sep 1980, *Cranfield* 2449 (PERTH); opposite Hale road on sporting complex site, Forrestfield, Nov 1977, *Cranfield* 222/77 (PERTH); Muchea, 6 km along road opposite the Brand Highway turnoff, Oct 1981, *Craven* 6950 (CANB); Diamond of the Desert Plain, Aug 1948, *Gardner* 9099 (PERTH); Tuttanning Reserve, SE of Pingelly, Oct 1977, *George* 14973 (PERTH); 0.5 miles (c. 0.8 km) S of 56 mile peg, Albany Highway, Dec 1960, *George* 2295 (PERTH); Mt Desmond, Oct 1960, *George* 1646 (PERTH); c. 5 km SE of Cockleshell Gully, on Cockleshell Gully road c. 10 km from junction with Jurien road, Sep 1988, *Henderson* H3139 (BRI); c. 5 km SE of Cockleshell Gully, on Cockleshell Gully road c. 10 km from junction with Jurien road, Sep 1988, *Henderson* H3138 (BRI); c. 12 km N of Eneabba, Aug 1976, *Hnatiuk* 760205 (CANB, PERTH); Brixton Road, Beckenham, 15 km E of Perth, Sep 1984, *Keighery* 7099 (PERTH); Melville Park, Dec 1897, *Morrison* (CANB, PERTH); 15 km WNW of Black Head, Jul 1974, *Newbey* 4253 (PERTH); 10 miles (c. 16 km) SW of Borden, Nov 1965, *Newbey* 1911 (PERTH); c. 1.4 km W of Brand Highway along main road to Jurien, Sep 1983, *Purdie* 5115 (CANB, MEL); Moore River National Park, Oct 1971, *Royce* 9462 (PERTH).

***Distribution and habitat*:** *Monotaxis grandiflora* var. *grandiflora* occurs from the Dongara - Three Springs area southeastward to the Stirling Ranges and to Mt Desmond, near Ravensthorpe in the east (Map 7). It is recorded as growing in open heath, mallee shrubland and *Banksia* woodland with heathy understorey or rarely in open eucalypt forest communities, on well drained sandy loam, clay loam, clay or gravelly soils.

***Phenology*:** Flowers have been collected from August to January, fruits from August to December and April.

7b. **Monotaxis grandiflora** var. **obtusifolia**

F.Muell. & Tate, Trans. & Proc. Roy. Soc. South Australia 16: 341 (1896); *Monotaxis grandiflora* var. *minor* Ewart, Proc. Roy. Soc. Victoria 22(1)(new

series): 17 (1909), *nom. illeg.* **Type:** Western Australia. near Gnarlbine, 12 Nov 1891, *R. Helms* (lecto, here chosen: MEL [MEL2066098]; isolecto: K, NSW).

Perennials to 20 cm high. Leaves with petiole up to 0.4 mm long; laminae lorate to linear, 2–10 mm long, 0.6–0.8(–1.3) mm wide, the apex obtuse or acute. Male flowers with calyx lobes ovate, 0.7–1.2 mm long and acute, and with petals ovate, 2.0–2.4 mm long. Female flowers with calyx lobes ovate to broadly ovate and 1.1–1.8 mm long with petals ovate or elliptic, 2.2–2.8 mm long.

***Selected specimens (from 35 examined)*: Western Australia.** 7 miles (c. 11 km) W of Kulja, 216 km NE of Perth, Aug 1963, *Aplin* 2570 (PERTH); 11 km W of Kulja, on road to Burakin, Aug 1963, *Aplin* 2570 (PERTH); 27 km N of Mt Ridley, Nov 1991, *Archer* 7119112 (MEL); 8 miles (c. 13 km) N of Wialki, Jul 1967, *Beard* 4723 (PERTH); 28 miles (c. 45 km) S of Coolgardie on Norseman road, Sep 1965, *Beauglehole* ACB13293 (MEL, PERTH); 64 km E of Southern Cross, Oct 1931, *Blackall* 939 (PERTH); 20.2 miles (c. 32.5 km) from Coolgardie towards Southern Cross, along Great Eastern Highway, Sep 1968, *Canning* WA/68 2441 (CANB); Yellowdine, Sep 1978, *Cranfield* 706 (PERTH); 15 km W of Mukinbudin on the Koorda road, Oct 1990, *Craven* 8635 & *Zich* (CANB); Burakin, Sep 1975, *Demarz* D5615 (PERTH); along State Vermin Fence No. 7, between 45 km and 65 km S of Great Western Highway, Nov 1985, *Dodd* 257 (PERTH); just SE of Buntine, on road to Wubin, Sep 1988, *Henderson* H3153 (BRI); 6 miles (c. 10 km) W of Cross Roads, Forrestania, Dec 1964, *Lullfitz* 4031 (PERTH); 135 km W of Salmon Gums and 25 km E of No.1 Rabbit Proof Fence, on Kumarl-Lake King road, Oct 1966, *Muir* 4420 (CANB, MEL); 5 km SSE of Walyahmonong Rock, c. 55 km NW of Bullfinch, Sep 1982, *Newbey* 9545 (CANB, PERTH); 11 km NNW of Southern Cross, Sep 1984 *Newbey* 10820 (PERTH); 21 km SW of 90 Mile Tank, Frank Hann National Park, Norseman-Lake King Road, Nov 1979, *Newbey* 6518 (PERTH); c. 34 km N of Widgiemooltha along Eyre Highway between Coolgardie and Widgiemooltha, Sep 1968, *Orchard* 1253 (CANB, PERTH); Kokardine Siding, Aug 1983, *Roberts* 152 (PERTH); 5.4 miles (c. 8.7 km) W of Belka, Sep 1987, *Smith* 934 (BRI, MEL).

***Distribution and habitat*:** *Monotaxis grandiflora* var. *obtusifolia* occurs in an area approximately bounded by Wubin, Widgiemooltha, Esperance and Narembeen (Map 8). It is recorded as growing in heathland, shrubland and open shrub mallee communities, on well drained deep yellow sandy or sandy loam soils on undulating plains, rarely on gravelly soils.

***Phenology*:** Flowers have been collected from July to November, fruits from September to December.

***Notes*:** *Monotaxis grandiflora* var. *obtusifolia* is distinguished from *M. grandiflora* var. *grandiflora* by its generally shorter leaves which lack a long apiculate point at the apex.

However, two specimens have been seen which are typical of *M. grandiflora* var. *obtusifolia* in aspect but they possess leaves terminated by an apiculum. These are *Henderson* H3153 (BRI) and *Wittwer* 1239 (PERTH).

8. Monotaxis paxii Grüning in A. Engler, Pflanzenr. H.58: 85/86 (1913). **Type citation:** 'Westaustralische Provinz: Coolgardie, Menzies, am Saume lichter Geholze, 375 m (Diels)' (holo: B (destroyed); lecto, here chosen: G. Grüning in A. Engler, Pflanzenr. H.58: 83, fig.14B (1913)).

Monotaxis sp. Ravensthorpe (M.A. Burgman 2154), Paczkowska & Chapman (2000).

***Illustration*:** G. Grüning (1913: 83, fig.14 B).

Glabrous, monoecious, diffuse herbaceous perennials to 20 cm high, with few to many stems arising from a rootstock. Stems sparingly branched, decumbent to erect, up to 1 mm across; young branchlets smooth or slightly striate when dried, pale green. Leaves shortly petiolate or sessile, alternate or subopposite or subwhorled distally on branchlets; stipules narrowly triangular, up to 0.5 mm long, with margins entire, red-brown, erect; petiole up to 0.5 mm long, plano-convex in transverse section; laminae lanceolate or narrowly elliptic, 3–15 mm long, 1–2 mm wide, with base cuneate to obtuse and apex acute with a short apiculum, flat or slightly concave, with margins entire, foveate adaxially and abaxially, concolorous, crustaceous and brown when dried; midrib obscure adaxially, prominent abaxially. Inflorescence sessile; bracts numerous; outer bracts broadly ovate, c. 0.9 mm long, with margins toothed, reddish

brown. Male flowers 3–6 per cyme; pedicels 1.1–2.3 mm long; calyx lobes ovate, 0.9–1.1 mm long, 0.5–0.6 mm wide, with apex acute and with margins erose, ± flat, yellow; petals ovate, 1.7–2.2 mm long including claw, 1.0–1.1 mm wide, with base shallowly cordate or auriculate, apex acute to obtuse and margins entire or erose, creamy white; glands c. 0.2 mm long, with terminal hairs up to 0.2 mm long; staminal filaments 1.1–1.2 mm long; anthers 0.1–0.2 mm long; connective tissue 0.3–0.4 mm long; rudimentary ovary present with 3 erect linear lobes c. 0.7 mm long. Female flowers 1–4 per cyme, pedicellate; pedicels 0.4–0.9 mm long; calyx lobes ovate, 1.1–1.5 mm long, 0.7–0.8 mm wide, with apex acute to shortly acuminate and margins erose, concavo-convex, of unknown colour when fresh; petals ovate, 2.4–2.5 mm long including claw, 1–1.2 mm wide, with base cuneate to truncate, apex acute and margins erose, ± flat, creamy-white with a reddish blush towards the margins; glands 5–10, 0.2–0.4 mm long, glabrous; ovary trigonal-globose, 1.4–1.5 mm across, 1.4–1.5 mm long; styles c. 1 mm long, 2-lobed; lobes c. four-fifths the length of style. Capsule globose, c. 3 mm long, 2.5–2.7 mm across, ± smooth. Seeds ellipsoid, slightly dorsi-ventrally flattened, 1.5–2 mm long, 1.1–1.3 mm wide, 0.9–1 mm deep; testa smooth, brown or reddish-brown; caruncle reniform in outline, 0.5–0.6 mm long, 0.9–1 mm across, ± white.

***Selected specimens (from 23 examined)*: Western Australia.** 54 miles (c. 87 km) E of Ravensthorpe, on road to Esperance, Oct 1963, *Aplin* 2662 (PERTH); 35.5 km due ENE of Muckinwobert Rock, 6.21 km NE of Melaleuca Road on West Point Road, Sep 1984, *Burgman* 3922 (PERTH); 19.4 km due SSE of Peak Eleanora, 12.76 km N of Rollands Road on Fields Road, Sep 1984, *Burgman* 3717 (PERTH); Thumb Peak Range, SW of Ravensthorpe, Oct 1965, *George* 7129 (PERTH); 23 km S of Cocklebiddy, Jul 1974, *George* 11865 (PERTH); 20 km NNE of Point Malcolm on escarpment, Sep 1976, *Hnatiuk* 761152 (PERTH); c. 8 km NW of Young River crossing on Ravensthorpe-Esperance main road, Sep 1968, *Jackson* 1294 (CANB, PERTH); c. 500 m W of western shore of Lake King, W of Lake King township, Oct 1995, *Lepschi* 2194 (BRI); 0.3 km ESE of Corner Road on Mills Road, c. 31.5 km NNW of mouth of Stokes Inlet, Oct 1997, *Lepschi* BJL3804 & *Fuhrer* (BRI); Frank Hann National Park, Oct 1978, *Monk* 400 (PERTH); 25 km W of Mt Maxwell, Sep 1974, *Newbey* 4345 (PERTH); 7 miles (c. 11 km) N of Scaddan, Oct 1974, *Newbey* 1400 (PERTH); Cape Le Grand National Park, E of Esperance, Oct 1969, *Royce* 8683 (PERTH); 21 km from Ravensthorpe towards Esperance, Sep 1983, *Taylor* & *Ollerenshaw* 2318 (CANB); S of Grasspatch (main road from Norseman to Esperance), Sep 1947, *Willis* (MEL); Fitzgerald River National Park, Oct 1970, *Wilson* 10171 (PERTH); Reserve W of Young River on main Ravensthorpe - Esperance Road, c. 80 km W of Esperance, Sep 1968, *Wilson* 7827 (PERTH); Tributary of Young River, c. 22 km N of Shoal Cape and 80 km W of Esperance, Sep 1968, *Wilson* 7801 (PERTH); 8 km S of Mt Ragged on track to Israelite Bay, Oct 1970, *Wilson* 10088 (PERTH); 7 miles (c. 11 km) N of Scaddan, Oct 1974, *Wittwer* W1400 (PERTH).

***Distribution and habitat*:** *Monotaxis paxii* is confined to the south-west of Western Australia where it occurs from the Thumb Peak Range and Lake King area eastwards to Cocklebiddy (Map 9). It is recorded as growing in heathland, shrubland and open shrub mallee communities, on shallow to deep sandy soils over limestone or clay.

***Phenology*:** Flowers and fruits have been collected from September and October, with one record for July.

***Typification*:** Grüning (1913) cited a single specimen 'Westaustralische Provinz: Coolgardie, Menzies, am Saume lichter Geholze, 375 m (Diels)' in the protologue of *Monotaxis paxii*. He clearly stated that he found this specimen in the Berlin Herbarium amongst specimens of *M. luteiflora*. No type material has been located at B but it is believed to have been destroyed during the Second World War. Searches for duplicates at other herbaria where duplicates may exist according to Stafleu and Cowan (1976), i.e. BM, MEL and CANB, have been unsuccessful. Grüning's description and illustration are clearly diagnostic and leave no doubt as to the application of the name. As there appears to be no extant holotype or isotype material available, the illustration in the protologue is here selected as lectotype, in accordance with Article 9.10 of the International Code of Botanical Nomenclature (ICBN) (Greuter *et al.* 2000). For the above reasons, nomination of an epitype is not considered necessary.

***Notes*:** *Monotaxis paxii* differs from other species of *Monotaxis* in having isolateral leaf morphology with stomata sunken on both surfaces.

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We would like to thank Gordon Guymer for making space and facilities available at BRI for the first author, the directors and curators

of B, CANB, K, LD, MEL, NSW and PERTH for loan of their holdings for study at BRI, Alex Chapman and Bob Chinnock for searching for type specimens on our behalf at E and BM while acting as Australian Botanical Liaison Officer at K, Gordon Guymer for photographing relevant types at W, colleagues at PERTH, especially Kevin Kenneally and Bruce Maslin, who helped process the second author's Western Australian collections and forwarded them to BRI when processing was complete, Will Smith (BRI) for the illustrations and Peter Bostock (BRI) for preparing the maps. Associated fieldwork from 1988 to 1992 by the second author and salary support for the first author for 1999 and 2000 was funded by grants from the Australian Biological Resources Study (ABRS), which are gratefully acknowledged.

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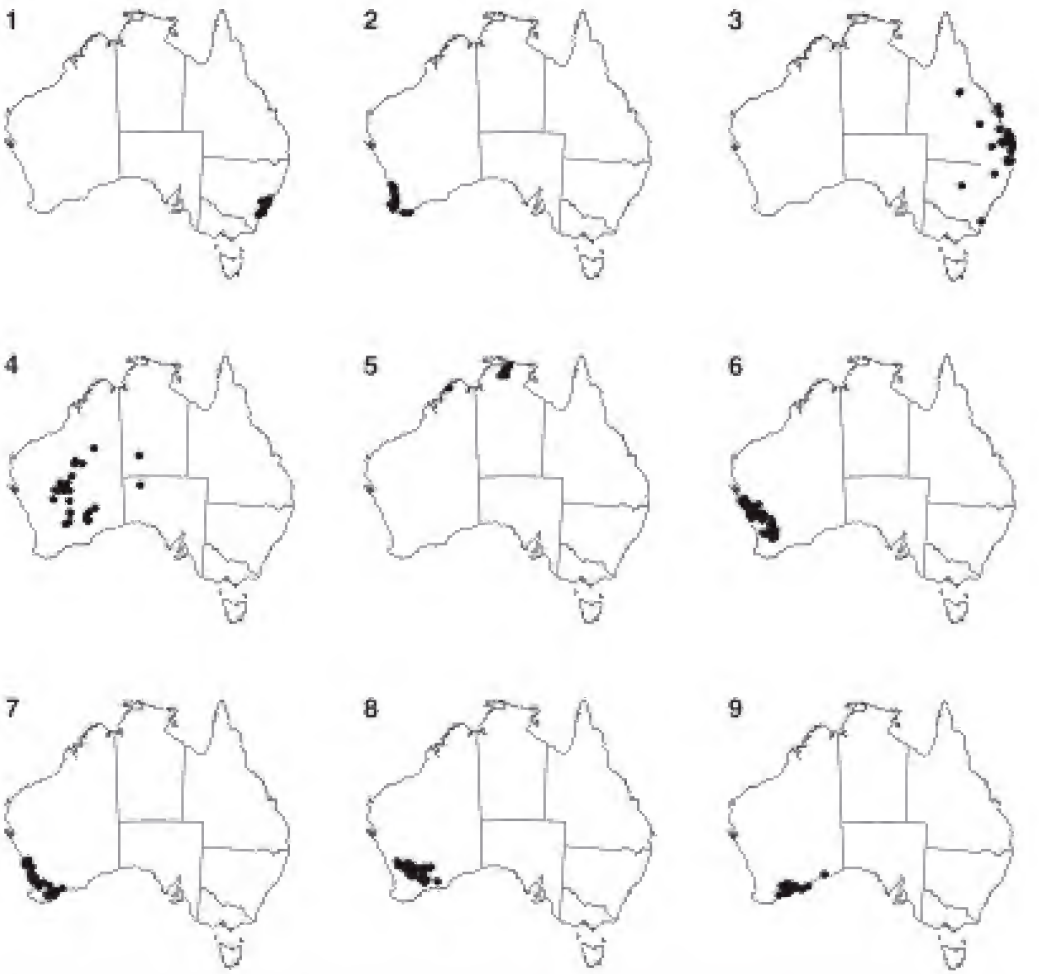
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Maps 1–9, Distribution of *Monotaxis* taxa. **1.** *Monotaxis linifolia* **2.** *Monotaxis occidentalis* **3.** *Monotaxis macrophylla* **4.** *Monotaxis luteiflora* **5.** *Monotaxis tenuis* **6.** *Monotaxis bracteata* **7.** *Monotaxis grandiflora* var. *grandiflora* **8.** *Monotaxis grandiflora* var. *obtusifolia* **9.** *Monotaxis paxii*

Index to Scientific Names

Names in bold type are accepted names and those in light are synonyms, etc. The numbers refer to the number of the species accepted in the above taxonomic treatment.

Hippocrepandra ericoides (Klotszch) Müll.Arg. 7a
Hippocrepandra gracilis Müll.Arg. 6
Hippocrepandra lurida Müll.Arg. 6
Hippocrepandra neesiana Müll.Arg. 6
Monotaxis bracteata Nees **6**
Monotaxis cuneifolia Klotzsch 2
Monotaxis ericoides Klotzsch 7a
Monotaxis gracilis (Müll.Arg.) Baill. 6
Monotaxis gracilis (Müll.Arg.) Baill. var. *gracilis* 6
Monotaxis gracilis var. *genuina* Grüning 6
Monotaxis gracilis var. *virgata* Grüning 6
Monotaxis grandiflora Endl. **7**
Monotaxis grandiflora Endl. var. ***grandiflora*** **7a**
Monotaxis grandiflora var. *minor* Ewart 7b
Monotaxis grandiflora var. ***obtusifolia*** F.Muell. & Tate7b
Monotaxis grandiflora var. *typica* Grüning 7a
Monotaxis linifolia Brongn. **1**
Monotaxis linifolia Brongn. var. *linifolia* 1
Monotaxis linifolia var. *cuneata* Grüning 1
Monotaxis linifolia var. *genuina* Grüning 1
Monotaxis linifolia var. *genuina* Müll.Arg. 1
Monotaxis linifolia var. *occidentalis* (Endl.) Müll.Arg. . 2
Monotaxis linifolia var. *tridentata* (Endl.) Müll.Arg. 1
Monotaxis lurida (Müll.Arg.) Benth. 6
Monotaxis luteiflora F.Muell. **4**
Monotaxis macrophylla Benth. **3**
Monotaxis megacarpa F.Muell. 6
Monotaxis neesiana Baill. 6
Monotaxis occidentalis Endl. **2**
Monotaxis oldfieldii Baill. 6
Monotaxis paxii Grüning **8**
Monotaxis sp. Ravensthorpe (M.A.Burgman 2154) 8
Monotaxis stowardii S.Moore 6
Monotaxis tenuis Airy Shaw **5**
Monotaxis tridentata Endl. 1

A review of *Crotalaria* L. (Fabaceae: Crotalarieae) in Australia

A.E.Holland

Summary

Holland, A.E. (2001), A review of *Crotalaria* L. (Fabaceae: Crotalarieae) in Australia. *Austrobaileya* 6 (2): 293–324. The genus *Crotalaria* L. in Australia is examined, and a new record noted: *Crotalaria prostrata* Rottl., new combinations are made: *Crotalaria cunninghamii* subsp. *sturtii* (*C. sturtii* R.Br.), *Crotalaria dissitiflora* subsp. *benthamiana* (*C. benthamiana* Pritzel), *Crotalaria novae-hollandiae* subsp. *crassipes* (*C. crassipes* Hook.) and *Crotalaria montana* var. *exserta* (*C. exserta* Domin). New varieties and subspecies are described: *Crotalaria medicaginea* var. *linearis*, *Crotalaria aridicola* subsp. *glabrata* and *C. aridicola* subsp. *densifolia*. Lectotypes are chosen for *Crotalaria cunninghamii* R.Br., *Crotalaria crispata* Benth., *Crotalaria brevis* Domin and *Crotalaria aridicola* Domin. A neotype is chosen for *C. benthamiana* Pritzel. A key to the species occurring in Australia is provided.

Keywords: *Crotalaria, Crotalaria prostrata, Crotalaria humifusa, Crotalaria mysorensis, Crotalaria membranacea, Crotalaria crispata, Crotalaria ramosissima, Crotalaria brevis, Crotalaria cunninghamii, Crotalaria sturtii, Crotalaria dissitiflora, Crotalaria benthamiana, Crotalaria novae-hollandiae, Crotalaria crassipes, Crotalaria montana, Crotalaria linifolia, Crotalaria exserta, Crotalaria medicaginea, Crotalaria trifoliastrum, Crotalaria aridicola*, Australia.

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Introduction

Crotalaria L. is a genus of *c.* 600 tropical and subtropical species most of which occur in tropical Africa (Polhill 1982). *Crotalaria* species, often called rattlepods, are herbs or shrubs with leaves simple, unifoliolate or digitately 3–7-foliolate. Flowers are in terminal, leaf-opposed or axillary racemes with bracts and bracteoles usually present. Flowers are usually yellow and red or brown veined, rarely mauve. The keel petal is prominently angled distally upwards. Stamen filaments are connate proximally into a tube open on the upper side, with long and short anthers alternating. Fruits are inflated and dehiscent and not septate, the seeds loose and "rattling" in the dry pod. Many species are known to be toxic, and some are used for fibre and green manure (Polhill 1982; Rudd 1991; Everist 1974).

In Australia, there are 36 species including 23 subspecies and varieties. Sixteen species of these are naturalised. Twenty species are considered to be native (or of pre-European introduction), 9 of which are endemic and 11 are widespread through SE Asia and India as well as northern Australia, New Guinea and Indonesia. Of the endemic species, 4 belong to *C.* sect. *Hedriocarpae* Wight & Arn, 2 to *C.* sect. *Calycinae* Wight & Arn., 2 to *C.* sect. *Crotalaria* and 1 to *C.* sect. *Dispermae* Wight & Arn. (Polhill 1982 - see key to Sections below).

Lee (1979) revised some of the complex endemic Australian species groups: *C. eremaea*, *C. dissitiflora* and *C. novae-hollandiae*. This work is taken a step further here, partly as a consequence of new material becoming available since Lee's work. Also, results of studies on some of the widespread Asian/Australian species complexes, i.e. the groups *C. medicaginea/C. trifoliastrum*, and *C. montana/C. nana/C. melanocarpa*, are here reported in relation to the Australian material. In order to account for the variation occurring in the Australian material in these two groups, new infraspecific taxa are described, and *C. aridicola* Domin and *C. brevis* Domin are circumscribed.

Materials and Methods

Herbarium specimens from AD, BM, BRI, CANB, DNA, K, MEL, NSW, P and PERTH

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were examined. These examinations were augmented with field observations where possible. The shape, size and colour variation of petals are best observed in fresh material. Polhill (1982) used receptacle, calyx, standard, keel and style characters to distinguish the sections of the genus. Lee (1978) mainly used flower size and shape, leaf shape and hair characters to separate species and subspecies. Unifoliolate species usually have longer petioles than those with simple leaves, and have a distinct articulation near the petiole apex (also see discussion under *C. cunninghamii* below). Stipules, if present, vary enormously in shape and size. Some species have caducous stipules, so that the immature shoots need to be examined. Bracts, found at the base of the pedicels, are often similar in appearance to the stipules, and may also be caducous. Bracteoles can occur on the calyx or variously positioned on the pedicel. The calyx lobe length, in relation to the calyx tube, is measured on the upper lobes except as otherwise stated. The calyx is often persistent in fruit. Petal measurements follow Lee (1978, 328), although only length and width are recorded here. Polhill (1982) and Niyomdham (1978) give more detailed information on characters and character states in *Crotalaria*. The concepts of subspecies and varieties used here are those of Davis & Heywood (1963).

Key to the Sections of *Crotalaria* in Australia

(adapted from Polhill, 1982: * indicates a naturalised taxon)

1. Beak of the keel petal not or slightly spirally twisted (up to 90°) 2
 Beak of the keel petal spirally twisted through more than 120° 4

2. Receptacle (hypanthium) prominent, 3–9 mm long; keel 1.6–5.5 mm long; calyx tips joined in bud; pod long stipitate.
 **C. sect. Grandiflorae** (Bak.f.) Polhill (**C. agatiflora*, **C. laburnifolia*).
 Receptacle up to 2 mm long, keel, calyx and legume not as above 3

3. Calyx 0.7–1.3 times as long as the keel, stipules often foliaceous
 **C. sect. Chrysocalycinae** (Benth.) Bak.f. (**C. incana, *C. goreensis*)
 Calyx up to half as long as the keel petal; stipules not foliaceous
 **C. sect. Hedriocarpae** Wight & Arn. (*C. dissitiflora, C. eremaea, C. smithiana, C. mitchellii, *C. pallida, *C. ochroleuca,*C. zanzibarica, *C. lanceolata, *C. micans*)

4. Calyx 2-lipped with a short upper lip, subequal to the corolla
 **C. sect. Calycinae** Wight & Arn (*C. alata, C. calycina, C. sessiliflora, C. humifusa,*C. prostrata, C. montana, C. brevis, C. ramosissima, C. crispata, *C. juncea, C. mysorensis*)
 Calyx not 2-lipped or with a slight lower lip, much shorter than the corolla 5

5. Seeds more than 2 per pod, exarillate; small anthers glabrous
 **C. sect. Crotalaria** (*C. cunninghamii, C. novae-hollandiae, C. verrucosa, C. retusa, C. quinquefolia, *C. spectabilis, *C. lunata, *C. grahamiana, *C. distans, *C. virgulata*)
 Seeds 2 per pod, often arillate; small anthers often spinulose
 **C. sect. Dispermae** Wight & Arn. (*C. medicaginea, C. aridicola*)

Key to Species of *Crotalaria* in Australia

1. Leaves with 3–7 leaflets 2
 Leaves simple or unifoliolate 19

2. Leaves with 5–7 leaflets 3
 Leaves with 3 leaflets 4

3. Leaflets obovate to oblanceolate, with L:W ratio 2–4:1 ***C. grahamiana*** Wight & Arn.
 Leaflets elliptic to linear, with L:W ratio 6–16:1 **C. quinquefolia** L.

4. Corolla 1.7–5.5 cm long; hypanthium prominent, ridged; calyx lobes joined at the tips in bud 5
 Corolla 0.5–1.5 cm long; hypanthium not prominent; calyx lobes always free 6

5. Calyx 1.8–3 cm long; pod 7–10 cm long ***C. agatiflora*** Schweinf.
 Calyx 0.9–1.7 cm long; pod 2.5–4.5 cm long ***C. laburnifolia*** L.

6. Lateral leaflets less than ½ the length of the terminal leaflet **C. eremaea** F.Muell.
 Lateral leaflets more than ½ the length of the terminal leaflet 7

7. Pod 3–7 mm long, seeds 1 or 2; keel beak twisted 8
 Pod more than 7 mm long, seeds more than 2; keel beak straight or twisted 9

8. Corolla 3–8 mm long; pod 3–5.5 mm long, beak 1 mm long **C. medicaginea** Lam.
 Corolla 8–14 mm long; pod 5–7 mm long, beak 1–2 mm long **C. aridicola** Domin

9. Stipules foliaceous, falcate, 5–25 mm long; pod held erect ***C. goreensis*** Guill. & Perr.
 Stipules, if present, not foliaceous, linear, subulate or filiform, 1–12 mm long; pod spreading or deflexed 10

10. Calyx lobes more than twice the length of the tube; corolla scarcely exceeding the calyx ***C. incana*** L.
 Calyx lobes shorter or slightly longer than the tube; corolla much longer than the calyx 11

11. Calyx lobes equal to or longer than the tube 12
 Calyx lobes shorter than the tube 16

12. Calyx 7–13 mm long, wing petals longer than keel; bracts 7–13 mm long ***C. micans*** Link
 Calyx 2.5–8 mm long, wing petals shorter than or equalling keel; bracts 0.7–5 mm long 13

13. Keel beak twisted 14
 Keel beak straight, not twisted 15

14. Corolla 10–15 mm long; pod 1.5–1.9 mm long ***C. distans*** Benth.
 Corolla 5–8 mm long; pod 1–1.3 mm long ***C. virgulata*** Klotzsh

15. Pod 3–5 cm long; pedicel 3–7 mm long ***C. pallida*** Aiton
 Pod 1.1–2.2 cm long; pedicel 1–4 mm long **C. dissitiflora** Benth.

16. Pod 5–7 cm long, 1.5–2 cm wide ***C. ochroleuca*** G.Don
 Pod 1–4 cm long, 0.3–0.8 cm wide 17

17. Wing petals longer than the keel; calyx 2–4 mm long ***C. lanceolata*** E.Mey.
 Wing petals equal to or shorter than the keel; calyx 3–7 mm long 18

18. Corolla yellow with no other colorations; pod 1.1–2.2 mm long **C. dissitiflora** Benth.
 Corolla veined red-brown, wings with a large purple spot at base; pod 2.7–4.5 mm long ***C. zanzibarica*** Benth.

19.Stipules decurrent, forming wings on the stem, 3–5 mm wide **C. alata** Buch.-Ham. ex D.Don
Stipules not decurrent, stem not winged 20

20.Stipules foliaceous, semi-lunate or falcate, 5–35 mm long 21
Stipules, if present, not foliaceous, ovate, lanceolate, linear or subulate, 0.5–18 mm long 22

21.Leaf margins undulate; corolla mauve to blue **C. verrucosa** L.
Leaf margins flat; corolla yellow ***C. lunata** Bedd. ex Polhill

22.Ovary hairy; pod pubescent or glabrescent 23
Ovary and pod glabrous 28

23.Corolla 24–43 mm long, greenish-yellow **C. cunninghamii** R.Br.
Corolla less than 20 mm long, yellow, yellow-brown, mauve or blue 24

24.Pod 6–9 mm long, equalling the calyx; plants often viscid; calyx lobe margins usually reflexed 25
Pod 10–40 mm long, much longer than the calyx; plants never viscid; calyx lobe margins not reflexed 26

25.Calyx lobes oblong, 1–3.5 mm wide, the margins flat or narrowly reflexed, often black **C. ramosissima** Roxb.
Calyx lobes ovate to orbicular, 3–7.5 mm wide, the margins broadly reflexed **C. crispata** F.Muell. ex Benth.

26.Calyx lobes longer than tube; pod velvety hairy ***C. juncea** L.
Calyx lobes equal to or shorter than tube; pod pubescent or glabrescent 27

27.Keel beak straight or nearly so; bracteoles inserted at base of calyx **C. eremaea** F.Muell.
Keel beak twisted; bracteoles inserted on the pedicel **C. novae-hollandiae** DC.

28.Leaves unifoliolate (the petiole with a distinct articulation) 29
Leaves simple (the petiole without an articulation) 30

29.Corolla 5–8 mm long; leaf lamina obovate to broadly elliptic, L:W ratio 1–2:1; both surfaces densely hairy **C. smithiana** A.T.Lee
Corolla 7–18 mm long; leaf lamina variable in shape, L:W ratio more than 1.5:1; upper surface either glabrous or pubescent..... **C. novae-hollandiae** DC.

30.Corolla much longer than the calyx 31
Corolla equalling the calyx, or slightly longer 33

31.Calyx 4–6 mm long; wing petals equal to or shorter than keel **C. mitchellii** Benth.
Calyx 8–20 mm long; wing petals longer than keel 32

32.Stipules ovate, 2.5–10 mm long ***C. spectabilis** Roth
Stipules linear to subulate, 1–2 mm long ***C. retusa** L.

33.Calyx 8–35 mm long, the lobes more than twice the length of the tube 34
Calyx 4–7 mm long, the lobes slightly longer or shorter than the tube 36

34.Stipules linear-lanceolate, 6–15 mm long **C. mysorensis** Roth
Stipules minute or absent 35

35.Corolla yellow, 12–18 mm long; calyx 18–35 mm long **C. calycina** Schrank
Corolla blue, 8–10 mm long; calyx 8–17 mm long **C. sessiliflora** L.

36.Stem prostrate, pilose; leaves ovate, obovate, broad-elliptic or orbicular, L:W ratio 1–2:1.37
Stem ascending or erect, pubescent; leaves narrowly oblong, narrowly elliptic or linear, L:W ratio 2–24:1 38

37.Stipules persistent, 1.5–3.5 mm long; pod 5–9 mm long ... **C. humifusa** Graham ex Benth.
Stipules minute or absent; pod 9–16 mm long ***C. prostrata** Rottl.

38.Leaves 2–8 cm long, L:W ratio 5–20:1; racemes 10–60 cm long; standard 4–7 mm long, emarginate at apex **C. montana** Heyne ex Roth
Leaves 0.5–3.5 cm long; L:W ratio 2–8:1; racemes 5–13 cm long; standard 6–9 mm long, acute or obtuse at apex **C. brevis** Domin

Section A. New records

1. *Crotalaria prostrata Rottl. in Willd., Enum. Hort. Berol. 744 (1809). **Type**: India, *Rottler* (holo: K, n.v.; photo: BRI).

Prostrate or ascending slender annuals. Stem pilose, hairs to 1.5 mm long. Leaves simple, broadly elliptic, ovate or lanceolate, 5–40 mm long, 3–20 mm wide, L:W ratio 1.5–2:1, apex acute or obtuse, base oblique to subcordate; both surfaces pilose; petiole to 1 mm long; stipules minute or absent. Racemes terminal or leaf-opposed, to 5 cm long; flowers 1–5; bract and bracteoles lanceolate, subulate, 1–2 mm long; bracteoles inserted just below calyx; pedicel 1.5–3.5 mm long. Calyx 4–6.5 mm long, 2-lipped, pilose; lobes longer than tube. Corolla slightly longer than calyx; standard obovate, emarginate, 4–7 mm long, glabrous, yellow; wings oblong, shorter than keel; keel 5–7 mm long, beak slightly twisted. Pod subsessile, oblong-ellipsoid, 9–16 mm long, 4–6 mm wide, glabrous; seeds 12–20. Seed 1.6–2.2 mm long, brown. Fig. 1A–E.

***Specimens examined*: Western Australia.** Old Presbyterian mission of old Kunmunya, Apr 1992, *Mitchell* 2347 & *Willing* (PERTH). **Northern Territory.** Tin Camp Creek, *c.* 2 km SW Myra Falls, Apr 1993, *Brennan* 9656 (DNA); Gove, mine area, Jul 1971, *Byrnes* 2349 (CANB, DNA).

***Distribution*:** Recorded in only a few places at Gove and Tim Camp Creek in the N.T., and at Kunmunya in W.A. Native of India and S.E. Asia.

***Phenology*:** Flowers April to November, possibly at other times.

***Discussion*:** This species is most closely related to *C. humifusa* and *C. acicularis*, but differs from those species in the much longer pod and minute or absent stipules.

Section B. Clarificaton of names

2. Crotalaria humifusa Graham ex Benth., Lond. J. Bot. 2: 476 (1843). **Type**: Himalaya, Nepal; *Wallich* 5421 (syn: K, n.v.; photos: BRI).

C. acicularis auct. non Buch.-Ham. ex Benth.: Stanley & Ross (1883, 1: 274): Hacker (1990: 110).

Illustration: Wheeler *et al.* (eds) (1992: 383, fig. 113f).

Prostrate annuals. Stem pilose, hairs 1–5 mm long. Leaves simple, suborbicular, broad-elliptic or broad-obovate, 6–25 mm long, 5–20 mm wide, apex rounded; both surfaces moderately pilose; petiole 1–2 mm long; stipules linear-lanceolate, 1–3.5 mm long. Racemes terminal or leaf-opposed, to 7 cm long; flowers 1–5; bract and bracteoles lanceolate, 1–3.5 mm long, inserted just below calyx; pedicel 2–3.5 mm long. Calyx 4–6 mm long, 2–lipped, villous; lobes longer than tube, upper 2 joined higher than lower 3. Corolla ± equalling the calyx; standard obovate to suborbicular, apex rounded or emarginate, 4–5 mm long, yellow, glabrous; wings *c.* 3 mm long, shorter than keel; keel 3.5–4.5 mm long, beak twisted. Pod sessile, oblong-ellipsoid, 5–9 mm long, 2–4 mm wide, glabrous; seeds 6–8. Seed 1–1.2 mm long, brown or green.

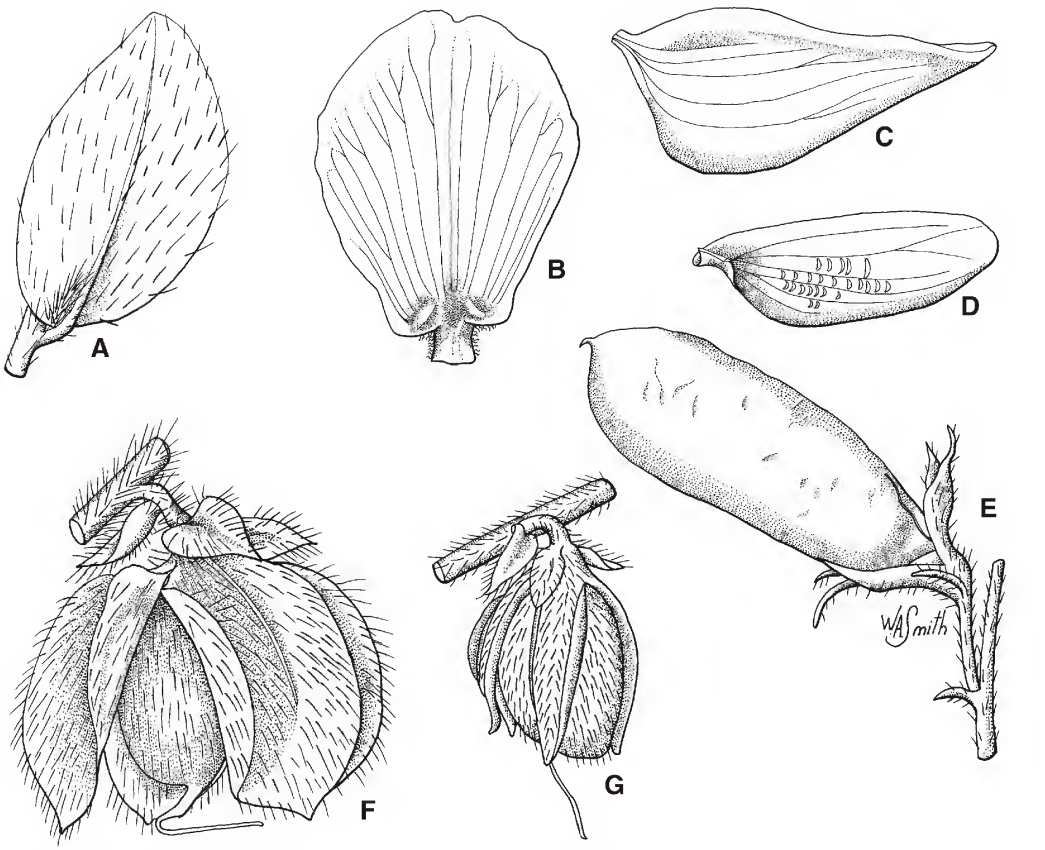


Fig. 1. A–E: ***Crotalaria prostrata.*** A. leaf × 2. B. standard petal × 8. C. keel petal × 8. wing petal × 8. E. pod × 4. F. ***Crotalaria crispata***, pod × 4. G. ***Crotalaria ramosissima***, pod × 4. A–E: *Byrnes* 2349 (DNA). F: *Leach* 4484 (BRI). G: *Cumming* 17619 (BRI).

***Specimens examined*: Western Australia.** Northern end of Airfield Swamp, Mitchell Plateau, Jun 1976, *Kenneally* 4862 (PERTH); 7 km NE of Beverley Springs Homestead, May 1979, *Muir* 644 (PERTH); Mertens Creek Falls tourist campsite, *c.* 15 km W of Mitchell Plateau, May 1988, *Pullen* 11.217 (CANB, PERTH); Koongarra, May 1981, *Rice* 4009 (CANB); Upper Camp Creek, E of Mitchell Plateau Airstrip, May 1991, *Willing* 433 (PERTH). **Northern Territory**. Canburra Creek, Elcho Island, Jul 1975, *Latz 6256* (AD, BRI, CANB, DNA, PERTH). **Queensland**. Cook District: Thursday Island, 1885, *Bauerlen s.n.* (BRI); Atherton, Aug 1901, *Betche* s.n. (NSW); Chester River, McIlwraith Ra., Jul 1978, *Clarkson* 2400 (BRI); Kilber Paddock, 5 km E of Gulf of Carpentaria, Edward R., Apr 1980, *Garnett* Y5 (BRI). North Kennedy District: Near Porters Creek, 27 km N of Ingham, Jun 1991, *Bean* 3261 (BRI, MEL); Mount Fox, Sep 1949, *Clemens s.n.* (BRI). South Kennedy: Dalrymple Heights and vicinity, Jul 1947, *Clemens s.n.* (BRI). Moreton district: Logan River, undated, *Scortechini s.n.* (BRI, MEL); Enoggera, undated, *Bailey s.n.* (NSW); D'Aguilar, Mar 1934, *Newman s.n.* (BRI).

***Distribution and Habitat*:** Scattered in coastal areas across northern Australia, from the Kimberley region in W.A., through the northern part of the N.T. and along the entire east coast of Qld. Also in Asia. It occurs in *Eucalyptus* woodland, on creek beds and alluvial flats, in sandy, seasonally damp soil.

***Phenology*:** Flowers March to October.

***Discussion*:** *Crotalaria humifusa* and *Crotalaria acicularis* Buch.-Ham. ex Benth. are very similar and the names have been variously applied in the Australian literature. Descriptions and differences are given by de Munk (1962), Niyomdham (1978) and Verdcourt (1979). In summary, *Crotalaria humifusa* has filiform to lanceolate bracts, 1–3.5 mm long, not cordate at the base, *Crotalaria acicularis* has ovate bracts, 3–6 mm long, cordate at the base.

I have identified all of the Australian material as *C. humifusa*. *C. acicularis* is occasionally cultivated but not known to be naturalised.

3. Crotalaria mysorensis Roth, Nov. Pl. Sp. 338 (1821). Type: East India, Mysore, *Heyne* (syn: K n.v. [photos at BRI]).

Crotalaria membranacea W.Fitzg., J. Proc. Roy. Soc. Western Australia. **Type**: Western Australia. Base of Inglis' Gap, King Leopold Range, May 1905, *Fitzgerald* 781 (holo: PERTH; iso: NSW; photos: BRI).

Illustrations: Wheeler *et al.* (eds) (1992: 384, fig. 114d.) as *C. membranacea*.

Perennial herbs or subshrubs to 1.5 m high. Stem pilose, hairs 4–5 mm long, brown. Leaves simple, narrowly elliptic, oblong or obovate, 1–8 cm long, 2–17 mm wide, apex acute or rounded; both surfaces pilose; petiole to 3 mm long; stipules lanceolate, 6–15 mm long, sometimes caducous. Racemes terminal or axillary, to 24 cm long; flowers 1–7; bract linear-lanceolate, shortly stipitate, 12–23 mm long; bracteoles 6–14 mm long, inserted at base of calyx; pedicel 2–10 mm long. Calyx 13–17 mm long, 2-lipped, densely pilose; lobes much longer than tube. Corolla scarcely exceeding calyx; standard oblong, ovate or elliptic, acute or obtuse, 13–18 mm long, pale yellow; outer surface pubescent; wings 8–10 mm long, shorter than or equalling keel; keel 10–14 mm long, beak slightly twisted. Pod subsessile, obovoid, 18–35 mm long, 11–18 mm wide, glabrous; seeds 15–60. Seed 2.8–3.3 mm long, brown.

***Selected specimens*: Western Australia.** Kalumburu road, 227.8 km by road N of Junction with Gibb River and Ellenbrae road, Apr 1988, *Aplin* 839 (CANB, PERTH); Mining Plant area, Mitchell Plateau, Aug 1978, *Beauglehole* 58970 (PERTH); Mount House, Apr 1960, *Blythe s.n.* (PERTH); 72 km S of Kalumburu, May 1971, *Byrnes* 2293 (DNA, PERTH); 40 km S of Kalumburu, May 1993, *Cowie* 4289 (PERTH); Barker River just N of Mount Hart Homestead, King Leopold Ranges, Jun 1988, *Edinger* 615 (PERTH); Gandjal Creek, Prince Regent River, Aug 1974, *George* 12371 (PERTH); Walsh Point, Warrender, Apr 1982, *Keighery* 4736 (PERTH); Camp Creek South, Mitchell Plateau, Jun 1976, *Kenneally* 5163 (PERTH); Crusher Vine Thicket, Mitchell Plateau, Jun 1976, *Kenneally* 5334 (PERTH); Kimbolton Station, May 1993, *Mitchell* 3095 (PERTH); Derby, Aug. 1970, *Payne s.n.* (PERTH); King Leopold Ranges; upper March Fly Glenn, *c.* 1.5 km S of Gibb River road, Jun 1988, *Sands* 4912 (PERTH); Stewart River 12 km N of Kimbolton Homestead, Jul 1977, *Telford* 6336 (PERTH).

***Distribution and Habitat*:** Occurs in the Kimberley region of W.A., from Kalumburu to Derby, in open *Eucalyptus* woodland and grassland, often on creek banks, mostly in clay soils. Also in India.

***Phenology*:** Flowers February to June.

***Discussion*:** Syntypes of *Crotalaria mysorensis* from India (Heyne), were examined and compared with the type material of *C. membranacea* from W.A. The material is similar except that the type material of *C. mysorensis* has 4–6 flowered racemes, whereas the type material of *C. membranacea* has 2–4 flowered racemes. However, the remaining Australian material has racemes varying from 2 to 7 flowers and is otherwise indistinguishable from the type material of *C. mysorensis*. *Crotalaria membranacea* is therefore here considered to be a synonym of *C. mysorensis*.

Roth (1821) describes 2 varieties of *C. mysorensis*: **a.** var. *pauciflora*, which has thin stem and leaves rarely covered with hairs, and short few-flowered racemes; **b.** var. *angustifolia*, which has narrow leaves totally covered with hairs. Australian material exhibits a continuum of variation in leaf size, shape and hairiness, the lower leaves elliptic to oblong and the upper leaves smaller, narrower and more densely hairy. Therefore no varieties are recognised here.

4. Crotalaria crispata F.Muell. ex Benth., Fl. Austral. 2: 179 (1864). Type: Northern Territory. Gravelly river bank, and plains and stony ridges on the Victoria River and its lower tributaries, Oct 1855–May 1856, *Mueller s.n.* (lecto, here designated: MEL [MEL 47637] upper right hand specimen [photo at BRI]).

Crotalaria sp. A. in Wheeler *et. al.* (eds) (1992)

Illustrations: Wheeler *et al.* (1992: 389, fig. 116e) as *Crotalaria* sp. "A".

Annual or perennial herbs to 50 cm tall. Stem, villous or sericeous, rarely subglabrous, hairs *c.* 1 mm long. Leaves simple, obovate or oblong, 7–40 mm long, 4–11 mm wide, apex rounded or emarginate, both surfaces hairy; petiole to 2 mm long; stipules linear, to 2 mm long, or absent. Racemes terminal, to 8 cm long; flowers 2–7; bract and bracteoles ovate, 2–4 mm long; bracteoles inserted just below calyx; pedicel 1.5–3 mm long. Calyx 6–11 mm long, 2-lipped; lobes ovate to suborbicular, acute or rounded, more than twice the length of the tube, 3–7.5 mm wide (including reflexed portion), the margins broadly reflexed, reflexed portion 1–2.5 mm wide; inner surface glabrous or slightly hairy, viscid. Corolla equal to or shorter than calyx; standard ovate, obovate, or elliptic, apex acute, 6–9 mm long, yellow, veins reddish-brown; wings oblong, 5–7 mm long, shorter than keel; keel 6–8 mm long, beak slightly twisted. Pod sessile, oblong-ellipsoid, 6–9 mm long, 3–5 mm wide, densely villous; seed 1. Seed 3.5–5 mm long, black or brown. Fig. 1F.

***Selected specimens*: Western Australia.** *c.* 200 km N of Halls Creek on road to Kununurra, Apr 1985, *Aplin* 1364, *Cranfield* & *Wheeler* (CANB, PERTH); Martins Gap, E of Ord River, Kimberley, Apr 1956, *Burbidge* 5158 (CANB, PERTH); NW of Deception Range, Mar 1978, *Hartley* 14783 (CANB, PERTH); 5 km SSE of Kununurra, Mar 1978, *Paijmans* 2323 (CANB, DNA, PERTH); 27 miles [43 km] NNE of Denham River Station, Jul 1949, *Perry* 2538 (BRI, CANB); 5 miles [8 km] E of Kimberley Research Station, Jul 1949, *Perry* 2564 (BRI, CANB, DNA, MEL); Smoke Creek, SW of Lake Argyle, Apr 1980, *Weston* 12084 (CANB, PERTH). **Northern Territory.** Katherine, Apr 1947, *Blake* 17410 (BRI, CANB, MEL); 12 miles [19 km] E of Old Crossing, Victoria River, May 1968, *Byrnes* NB726 (AD, BRI, DNA, PERTH); Edith River, Mar 1961, *Chippendale* NT7543 (DNA, CANB); 26.2 miles [41.9 km] SW of Willeroo Homestead, May 1960, *Chippendale* NT6848 (BRI, CANB, DNA, PERTH); Katherine Gorge N.P., Apr 1981, *Craven* 14205 (BRI, DNA, CANB, MEL); Keep River N.P., Apr 1990, *Evans* 3162 (CANB, DNA); 60 km NE of Maraboy Police Station, Mar 1965, *Lazarides* 54 & *Adams* (CANB, DNA); Yambarran Range, 19 km NE of Mount Millikmonmir, May 1994, *Leach* 4484 & *Walsh* (BRI, MEL); Flying Fox Creek between Beswick and Mainoru Stations, May 1974, *Pullen* 9350 (DNA, CANB, NSW). **Queensland.** Burke District: Between Gilbert Telegraph Station & crossing of Gibert River Lagoons, *Armit* 598 (MEL); Near Saxby River, 1883, *Palmer s.n.* (MEL); On track *c.* 1.5 km N of Carron River, *c.* 41 km NE Croydon (site 14), May 2001, *Turpin* GPT57 & *Thompson* (BRI).

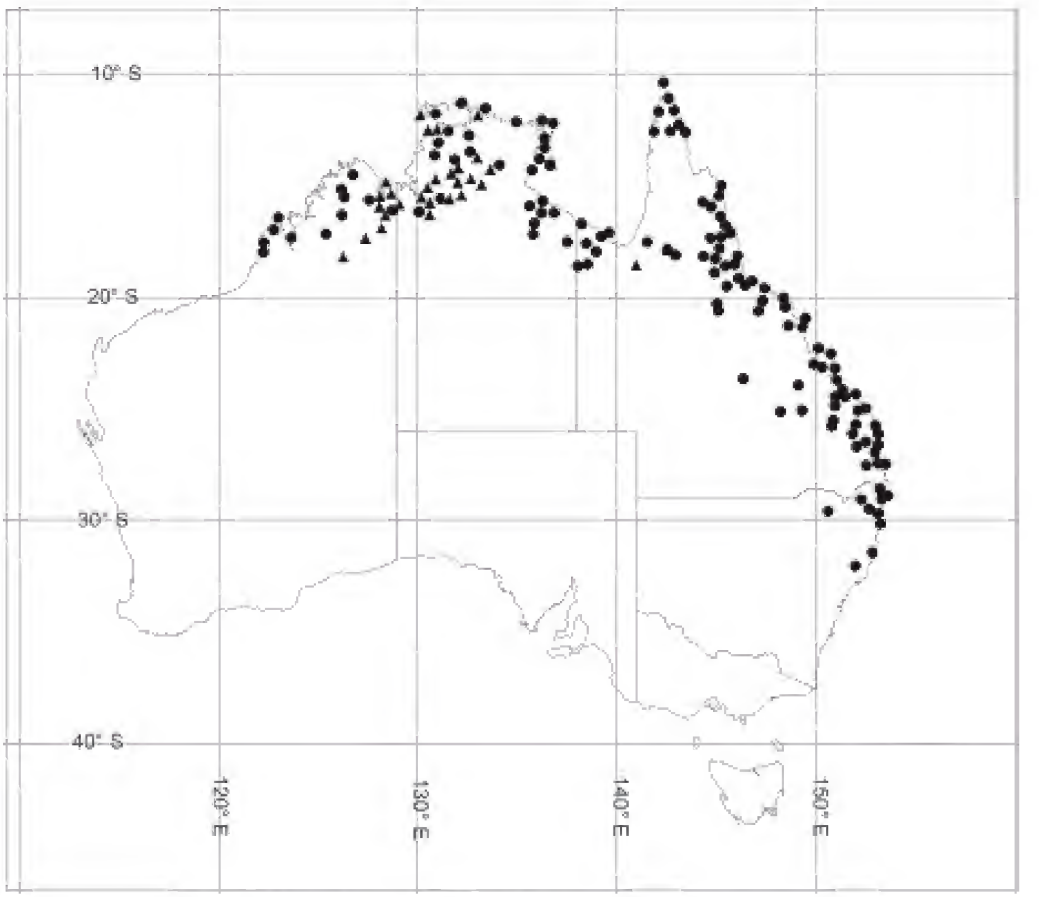
***Distribution and habitat*:** Northern Australia from the King Leopold Range in north-western W.A., across the N.T., and as far east as Croydon in northern Qld. Occurs in open woodland and grassland, often near rivers or swamps, in loamy or sandy soil. Map 1.

***Phenology*:** Flowers February to October.

***Discussion*:** *Crotalaria crispata* and *Crotalaria ramosissima* Roxb. (see below) have been confused in the Australian literature and the circumscription and lectotypification of *C. crispata* is therefore necessary. *Crotalaria crispata* is most easily distinguished from the widespread *C. ramossisima* by the width of the calyx lobes (including reflexed portion): C. crispata has calyx lobes 3–7.5 mm wide and *C. ramosissima* has calyx lobes 1–3.5 mm wide. These two species are very closely related but there are no intermediate forms in the Australian material. *C. crispata* appears to be endemic.

***Lectotypification*:** The collections cited by Bentham are: **a.** Islands of the Gulf of Carpentaria, *R.Brown s.n.* (BM); **b.** Victoria, Fitzmaurice and Baines Rivers, Oct 1855-May 1856, *F.Muell.* (MEL[MEL 47637]). The label on the MEL sheet has the name *C. crispata* written under the name *C. ramosissima* Roxb. followed by "Gravelly river bank, and plains and stony ridges on the Victoria River and its lower tributaries". Of the three specimens on this sheet, the upper two have broad calyx lobes (*C. cristata*) and the lower one has narrow calyx lobes (*C. ramosissima*). The Brown specimen (BM) from the Gulf of Carpentaria also has narrow calyx lobes. Bentham appears to have included both taxa (broad and narrow calyx lobes) in his description, but states that *C. crispata* resembles *C. ramosissima* "in many respects, but which, in its large flowers and broad, reflexed viscous bracts [calyx lobes?], is nearer to *C. lunulata* Heyne." *C. lunulata,* however, differs markedly from both species in the calyx which is much shorter than the corolla, and the pod which is *c.* 15 mm long.

The upper right hand specimen on the MEL sheet [MEL 47637] is therefore here chosen as the lectotype for the name *C. crispata*. The upper left hand specimen represents the more densely hairy form of this species. The lower specimen on this sheet and the Brown specimen (BM) are correctly



Map 1. Distribution of ***Crotalaria brevis*** ● and ***Crotalaria crispata*** ▲.

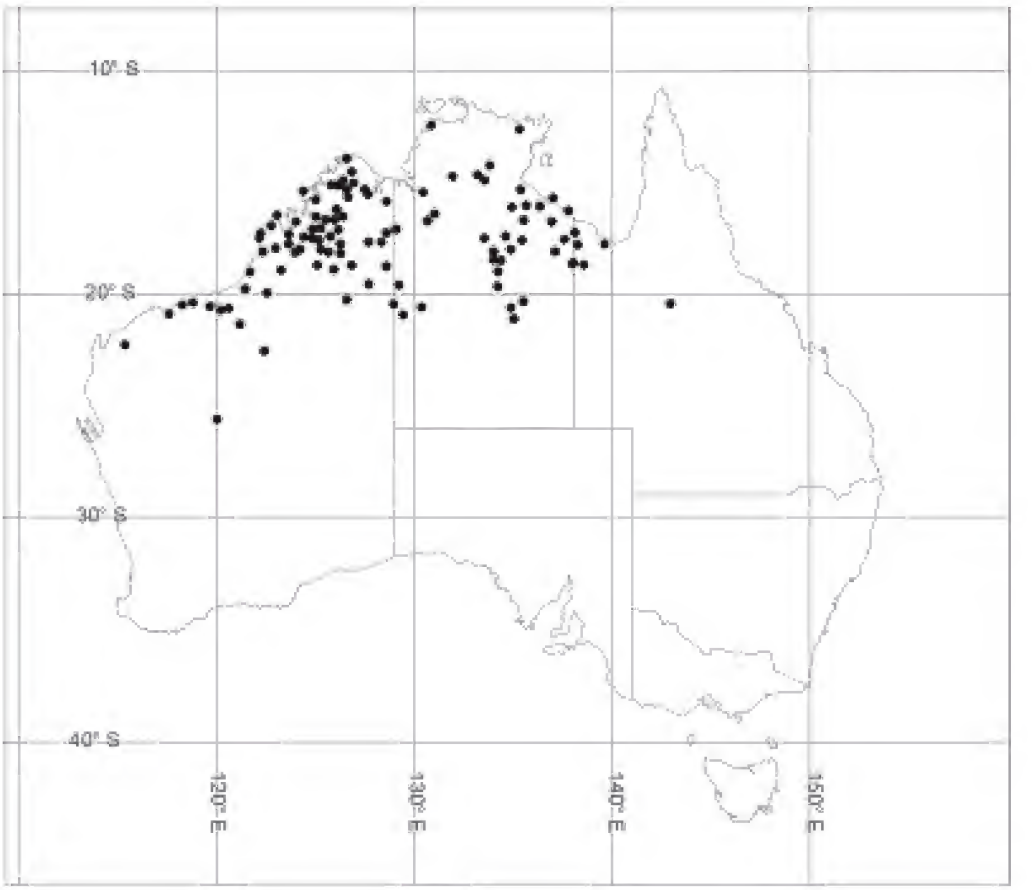
identified as *C. ramosissima*.

5. Crotalaria ramosissima Roxb., Fl. Indica (Carey) 2nd edn. 3: 268 (1832). **Type**: India. "Native to the interior parts of Benghal", *Wallich* 5380 (holo: K, n.v.; photo: BRI).

Illustration: Wheeler *et al.* (eds) (1992: 383, fig. 113c) as *C. crispata*.

Annual or perennial herbs to 70 cm tall; stem villous or nearly glabrous; hairs *c.* 1 mm long. Leaves simple, obovate or oblong, 5–28 mm long, 2–9 mm wide, apex rounded; both surfaces villous; petiole to 2 mm long; stipules minute or absent. Racemes terminal, to 12 cm long; flowers 4–21; bract and bracteoles ovate, 2–6 mm long; bracteoles inserted just below calyx; pedicel 1–3.5 mm long. Calyx 7–11 mm long, 2-lipped; lobes oblong, more than twice the length of the tube, 1–3.5 mm wide (including the reflexed portion), the margins slightly recurved to reflexed, reflexed portion *c.* 1 mm wide; inner surface often black, viscid. Corolla equal to or shorter than calyx; standard obovate or elliptic, apex acute, 5–9 mm long, 3–5 mm wide, yellow, veins reddish-brown; wings oblong, 4–7 mm long, shorter than keel; keel 5–8 mm long, beak slightly twisted. Pod sessile, oblong-ellipsoid, 6–9 mm long, 3–5 mm wide, villous; seed 1. Seed 3–4 mm long, brown. Fig. 1G.

***Selected specimens*: Western Australia.** 25 km W of Petermarer Creek crossing by NW coastal Hwy, *c.* 14 km by road ENE of main Port Hedland-Wittenoom road, Aug 1978, *Barker* 2787 (AD, MEL); Cape Leveque, Apr 1988, *Dunlop* 7821 (DNA, MEL, PERTH); Red Dune, near Edgar Range, SE of Broome, Aug 1976, *Kenneally* 5549 (CANB, PERTH); 75 km W of Wyndham, *c.* 7 km SSW of Paradise



Map 2. Distribution of ***Crotalaria ramosissima.***

Pool on Ernest River, NE Kimberley, Mar 1978, *Lazarides* 8647 (CANB, DNA, PERTH); Hann River, 48 miles [77 km] W of Tableland Station, Oct 1959, *Lazarides* 6434 (BRI, CANB, DNA, PERTH); Bungle Bungle N.P., 7 km NNW of Goose Hole Yard, Ord River, Jun 1989, *Menkhorst* 435 (PERTH, DNA); 6 miles [10 km] W Bloodwood Bore, Balweena Reserve, Aug 1969, *Nelson* 1934 (DNA, MEL, PERTH); 4 km SW of Shay Gap (town), *c.* 160 km E of Port Hedland, Jul 1984, *Newbey* 10281 (CANB, PERTH). **Northern Territory.** South bank of Katherine River near junction with Limestone Creek, Oct 1946, *Blake* 17222 (BRI, CANB, DNA); Burrabelly Waterhole, Frew River, Feb 1972, *Dunlop* 2497 (BRI, CANB); Ryans Bend Waterhole, Jun 1971, *Henry* 40 (BRI, CANB, MEL); 15 miles [24 km] SW of Inningarra Range, Aug 1970, *Maconochie* 945 (AD, BRI, DNA); 39 miles [62 km] E of Beswick, Jun 1972, *Maconochie* 1425 (BRI, CANB, DNA); Elkedra Station Creek crossing 14 km NW of Homestead on Hatches Creek road via jump-up, Aug 1979, *Morton* 235 (DNA, MEL); 10 miles [16 km] NNE of Borroloola, Jul 1948, *Perry* 1783 (AD, BRI, CANB, DNA, MEL); Arnhem land, Yirrmal, Aug 1986, *Scarlett* 232 & *White* (CANB, DNA). **Queensland.** Burke District: Nicholson River, May 1940, *Jensen s.n.* (BRI); Richmond, Westmoreland, Lagoon Creek, off track to Camp Ridgeway, May 1997, *Forster* PIF21008 & *Booth* (BRI, MEL).

Distribution and habitat. Northern Australia, from Port Hedland in W.A., through the northern part of the N.T. and in north-western Qld as far east as Richmond. Occurs in open woodland, open shrubland and grassland, usually near creeks and rivers, in sandy soil. Also in India and SE Asia. Map 2.

Phenology. Flowers most of the year, more commonly in the winter months.

6. Crotalaria brevis Domin, Biblioth. Bot. 89 (2): 126 (1925). **Type**: North Coast, 1802-3, *R.Brown* 5092, (lecto, here designated: K specimen on upper half of sheet: photo: BRI).

Crotalaria sp. B in Wheeler *et al.* (eds) (1992)

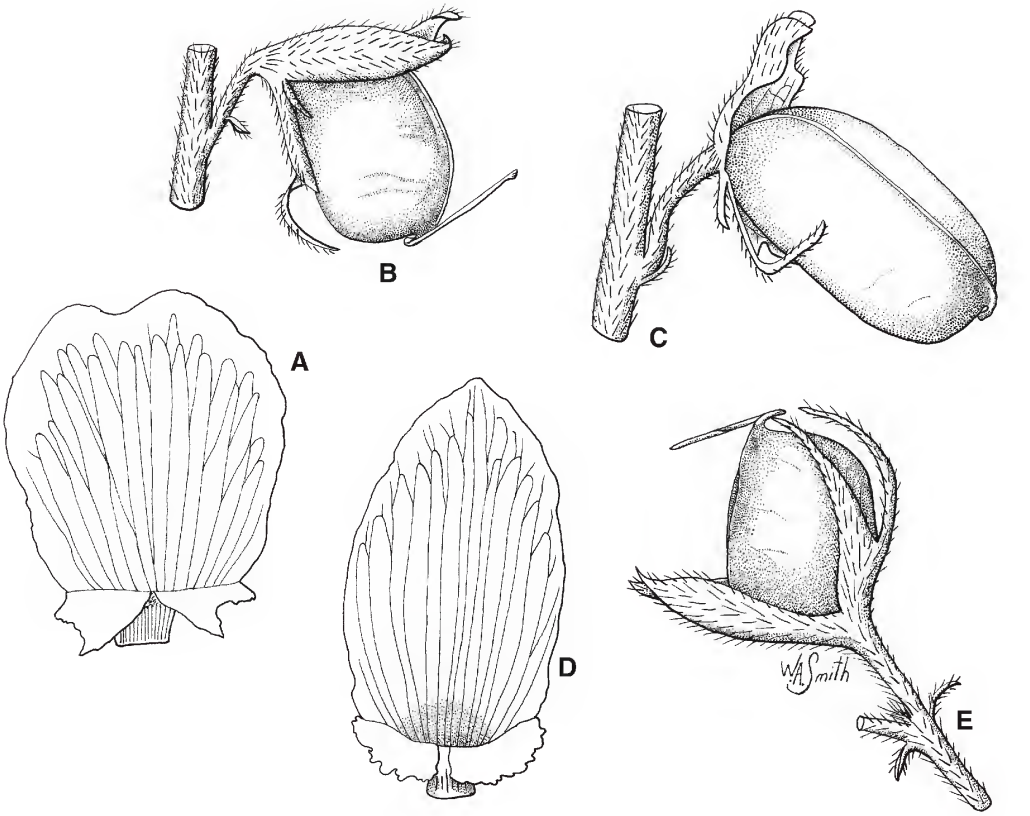


Fig. 2. A, B: ***Crotalaria montana*** var. ***angustifolia***. A. standard petal × 8. B. pod × 4. ***C. montana*** var. ***exserta***. C. pod × 4. D, E: ***C. brevis.*** D. standard petal × 8. E. pod × 8. A, B: *Bean* 11381 (BRI). C: *Forster* PIF 22182 (BRI). D, E: *Leach* 2927 & *Cowie* (BRI).

Illustrations: Wheeler *et al.* (1992: 389, fig. 116f) as *Crotalaria* sp. "B".

Erect, ascending or decumbent annual or perennial herbs. Stem several to many, to 40 cm long, moderately to densely pubescent, rarely glabrous; hairs spreading or appressed. Leaves simple, elliptic to obovate, or oblong; 6–35 mm long, 1–10 mm wide, L:W ratio 2–10:1, apex acute or obtuse; upper surface nearly glabrous or both surfaces pubescent, hairs appressed or spreading, to 1.5 mm long; petiole to 2 mm long; stipules absent. Racemes 0.5–13 cm long; flowers 1–10; bract and bracteoles linear, 1–4 mm long; bracteoles inserted on the calyx; pedicel 2–6 mm long. Calyx 6–9 mm long, pubescent; upper 2 lobes joined nearly to the apex; lower lobes longer than tube. Corolla equalling calyx or slightly longer; standard elliptic, ovate, obovate or oblong, acute or obtuse, auriculate, 6–9 mm long, 3–5 mm wide, yellow, veins reddish; wings oblong to obovate, shorter than keel; keel 6–9 mm long, beak twisted. Pod sessile, oblong-ellipsoid, 5–11 mm long, 3.5–6 mm wide, glabrous; seeds 8–14. Seed 1.5–2.5 mm long, brown or olive. Fig. 2 D–E.

***Selected specimens*: Western Australia.** Where Balk Creek south crosses main road, Apr 1992, *Carter* 520 (DNA, PERTH); 73 km W of Wyndham, 13 km S of Paradise Pool, Mar 1978, *Lazarides* 8645 (DNA, PERTH); King Edward River, Jun 1987, *Keighery* 9005 (PERTH); roadside near Cable Beach, Jan 1992, *Mitchell* 1948 (DNA, PERTH); Manguel Creek Station, S of the Derby to Broom road, Apr 1968, *Payne s.n.* (PERTH): Kunnunurra, Lake Argle road, 60 km from Kununurra, Apr 1977, *Pullen* 10.688 (CANB, PERTH). **Northern Territory.** Giddy River crossing, Jun 1972, *Byrnes* 2594 (CANB, DNA); 4.3 miles [6.9 km] NW of Pine Creek, Mar 1961, *Chippendale* NT7609 (AD, BRI, CANB, DNA, PERTH); Kapalga, Feb 1977, *Collins* 226 (CANB, DNA); Berrimah, May 1989, *Cowie* 744 (DNA, MEL); Groote Eylandt, 7 km SSE of Alyangula, Apr 1992, *Cowie* 2541 (DNA, MEL); 8 miles [13 km] NE of El Sharana Mine, Feb 1973, *Lazarides 7869* (CANB, DNA); Bessie

Springs, McArthur River Station, Jun 1977, *Must* 1537 (DNA, CANB); 50 miles [80 km] E of Borooloola Station, Aug 1964, *Perry* 1835 (DNA); 12 miles [19 km] NE of Katherine, Jan 1965, *Wilson* 83 (BRI, CANB, DNA). **Queensland.** Burke District: Lawn Hill N.P., Apr 1997, *Forster* PIF 20880 & *Holland* (BRI); 46 km NW of old Corinda outstation, May 1974, *Pullen* 9164 (BRI, CANB). Cook District: Newcastle Bay, May 1948, *Brass* 18748 (CANB); Mount Molloy, Apr 1962, *McKee* 9109 (BRI). North Kennedy District: Clarke River, Jan 1982, *Pedley* 4824 (BRI, MEL). South Kennedy District: Shoal Point, Mackay, Feb 1993, *Batianoff* 9302402 (BRI). Leichhardt District: Blackdown Tableland, *c.* 3–5 km W of Mimosa Creek campsite, 32 km SE of Blackwater, Apr 1971, *Henderson* 749 (BRI, MEL). Port Curtis District: Cannona, 40 km N of Rockhampton, Jun 1996, *Anderson* 4992 (BRI). Maranoa District: 1.5 km SE of Mount Moffatt Homestead, Mount Moffatt N.P., Jan 1998, *Bean* 12960 (BRI). Wide Bay District: Welcome Creek, *c.* 5 km from Moore Park N of Bundaberg, Nov 1978, *Stanley* 78134 (BRI). Moreton District: North Stradbroke Island, Point Lookout, Aug 1969, *Coveny* 1971(BRI, NSW). **New South Wales.** Lower Slopes of Gloucester Buckets at N end, *c.* 2 km W of Gloucester, Jan 1994, *Coveny* 16737 (BRI, NSW).

***Distribution and habitat*:** Northern and eastern Australia, from Roebuck Bay in W.A., across the N.T., and along the east coast of Australia as far south as Gloucester in N.S.W. Occurs in *Eucalyptus* woodlands and forests, in a variety of soils. Map 1.

Phenology: Flowers December to August.

***Discussion*:** *C. brevis* is easily distinguished from *C. montana* by the shorter racemes, fewer flowers and the standard petal which is ovate to elliptic, 3–5 mm wide and acute or obtuse at apex. The length, direction and density of hairs varies from moderate to dense, spreading or appressed, 1–3 mm long. A few specimens from Western Australia have smaller pods 5–7 mm long and 3.5–4 mm wide (species "B" in Wheeler *et al.* (1992)): Flats between Bell Creek and the King Leopold Range, May 1988, *Goble-Garratt* 667 (PERTH); Mount Elizabeth Station, NE of Derby & SW of Wyndham, May 1968, *Hutchinson* 2 (PERTH).

Crotalaria brevis, C. nana Burm. and *C. melanocarpa* Wall. ex Benth. are closely related species, probably part of a complex extending from India to Australia. According to Domin (1925), *C. nana* differs from *C. brevis* in the "smaller flowers in heads and smaller fruits". Niyomdham (1978) and Rudd (1991) describe *C. nana* as having flowers and pods *c.* 5 mm long, smaller than those of any Australian material. I therefore conclude that *C. nana s.s.*, does not occur in Australia.

According to Niyomdham (1978), *C. melanocarpa* has an erect habit (to 50 cm tall), leaves 20–40 mm long, standard petal acute, 5.5 mm × 4 mm, and pods 7 mm × 4 mm. A few eastern Queensland specimens are similar to the type material of *C. melanocarpa*: Castle Hill, Townsville, *Bean* 4074 (BRI); Herberton, 1.5 km W on Petford Rd, *Conn* 1132 & *Clarkson* (BRI). However, these character states do not clearly separate these specimens from of the remaining specimens identified as *C. brevis*.

At the present time, the name *C. brevis* is retained for Australian material. This taxon is considered to be endemic and is distinguished from *C. melanocarpa* by the larger flowers and pods. However, several forms are represented in the type material, and circumscription and lectotypification is therefore necessary. Examination of the full extent of the variation present in non-Australian material will be needed in order to clearly define all of the taxa and correctly apply names.

***Lectotypification*:** Eight collections are cited by Domin: **a.** North Coast, *R.Brown* 5092, (K, upper half of sheet); **b.** McAdam Range, *F.Mueller* (K, lower half of same sheet as a.); **c.** Yarraba, Jan–Feb 1910, *K.Domin* (PR [PR527119]); **d.** Atherton, Jan–Feb 1910, *K.Domin* (PR [PR527120]); **e.** Mareeba, Jan–Feb 1910, *K.Domin*, (PR [PR527118]), (c., d. and e. are on the same sheet); **f.** Pentland (2 sheets), Mar 1910, *K.Domin* (PR [PR527123]) and *K.Domin* (PR [PR527117]); **g.** Cape York, Nov 1849, *J. MacGillivray* 14 XI (not seen); **h.** Voyage of Rattlesnake, Botany No. 525, *A.Dietrich* 2456 (PR [PR527121], BRI, CANB); **i.** *R.Brown* 5091, Iter Australiense 1802-05 (not seen). Specimen **a.** is here chosen as lectotype. This specimen closely agrees with Domin's description, and represents a form that is common across northern Australia.

Section C. New combinations

7. Crotalaria cunninghamii R.Br., in Sturt, C., Narr. Exped. C. Australia, Bot. App. 71 (1849). **Type**: barren shores of Goodenough Bay, SE of Cygnet Bay, NW

Coast, 1818, *A. Cunningham* (lecto, here designated: K (lower right hand specimen); photo: BRI).

Shrub to 4 m high. Stem stout, softly woody, velvety tomentose. Leaves unifoliolate, rarely trifoliolate; lamina broadly elliptic, ovate or suborbicular, 2–13 cm long, 1–8 cm wide, apex obtuse or retuse; both surfaces tomentose; petiole 0.5–4.5 cm long; stipules subulate, 2–18 mm long. Racemes terminal or axillary, to 35 cm long; flowers 1–52; bract ovate–lanceolate, 5-17 mm long; bracteoles 1–14 mm long, inserted on the pedicel; pedicel 5–30 mm long. Calyx 11–30 mm long, velvety, lobes equal to or longer than tube. Standard ovate, apex acute, 20–43 mm long, greenish yellow, veins purple; wings ovate or elliptic, shorter than keel; keel 35–60 mm long, beak twisted. Pod stipitate, oblong-clavate, 3–6 cm long, 1–1.5 cm wide, velvety tomentose; seeds 3–16. Seed 4–7 mm long, brown.

Two subspecies are recognised here.

Key to subspecies of *Crotalaria cunninghamii*

Petiole to 2.5 cm long; racemes 0.1–3.5 cm long; flowers 1–19 **7a.** subsp. **cunninghamii**
Petiole to 4.5 cm long; racemes 5–35 cm long; flowers 20–52 **7b.** subsp. **sturtii**

7a. Crotalaria cunninghamii R.Br. subsp. **cunninghamii**

Illustrations: Hooker (1852: plate 829); Jessop (ed.) (1981: 154, fig. 176); Wheeler *et al.* (eds) (1992: 381, fig. 112).

Leaves always unifoliolate; petiole to 2.5 cm long. Racemes often appearing to be axillary, 0.1–3.5 cm long; flowers 1–19. Calyx lobes slightly longer than the tube to more than twice the length of the tube. Keel petal 37–60 mm long.

***Selected specimens*: Western Australia.** Broome, new jetty area, Aug 1965, *Beauglehole* 11251 (MEL, PERTH); Stewart River near Oobagooma road N of junction of Robinson Rivers, 74 km NNE of Derby, Jun 1976, *Beauglehole* 52879 (PERTH); Between Kimberley Research Station and Martins Gap, Apr 1956, *Burbidge* 5125 (BRI, CANB, MEL, PERTH); Dampier district, Cape Keraudren, Aug 1974, *Carr* 4518 (PERTH); Great Sandy Desert, May 1984, *Fatchen* 872 (AD); 4 km S of Cape Bertholet, Dampierland N of Broome, Apr 1977, *Kenneally* 6050 (PERTH); Kunnunurra township, Jun 1975, *Symon* 10326 (AD, CANB, PERTH). **Northern Territory.** Gardiner Range, far West Tanami, Jun 1996, *Albrecht* 7793 (DNA); 32 km W of Muchaty Homestead, Apr 1974, *Hagan s.n.* (DNA); 11 km SW of Sangsters Bore, Tanami Desert, Jun 1991, *Latz* 11969 (DNA); Lake Mackay on Island in SE area of lake, Oct 1992, *Latz* 13016 (DNA); Mount Young, Nathan River Stn, Nov 1987, *Russell-Smith* 6725 (BRI, DNA); 17 km E of Calvert River mouth, Jun 1987, *Thomson* 1799 (DNA); Newcastle Waters, Jul 1958, *Trapnell* 63 (BRI); Kalkaringi area, Leichhardt Springs, Aug 1993, *Whiteman* 6209 (DNA).

***Distribution and habitat*:** North-western W.A. from Broome to the Ashburton River and in the northern half of the N.T. as far east as the Calvert River. Occurs on sand dunes, coastal dunes, and in grassland or grassy woodland, on sandy soil. Map 3.

***Phenology*:** Flowers mainly from May to October.

7b. Crotalaria cunninghamii subsp. **sturtii** (R.Br.) A.E.Holland, **comb. nov.**

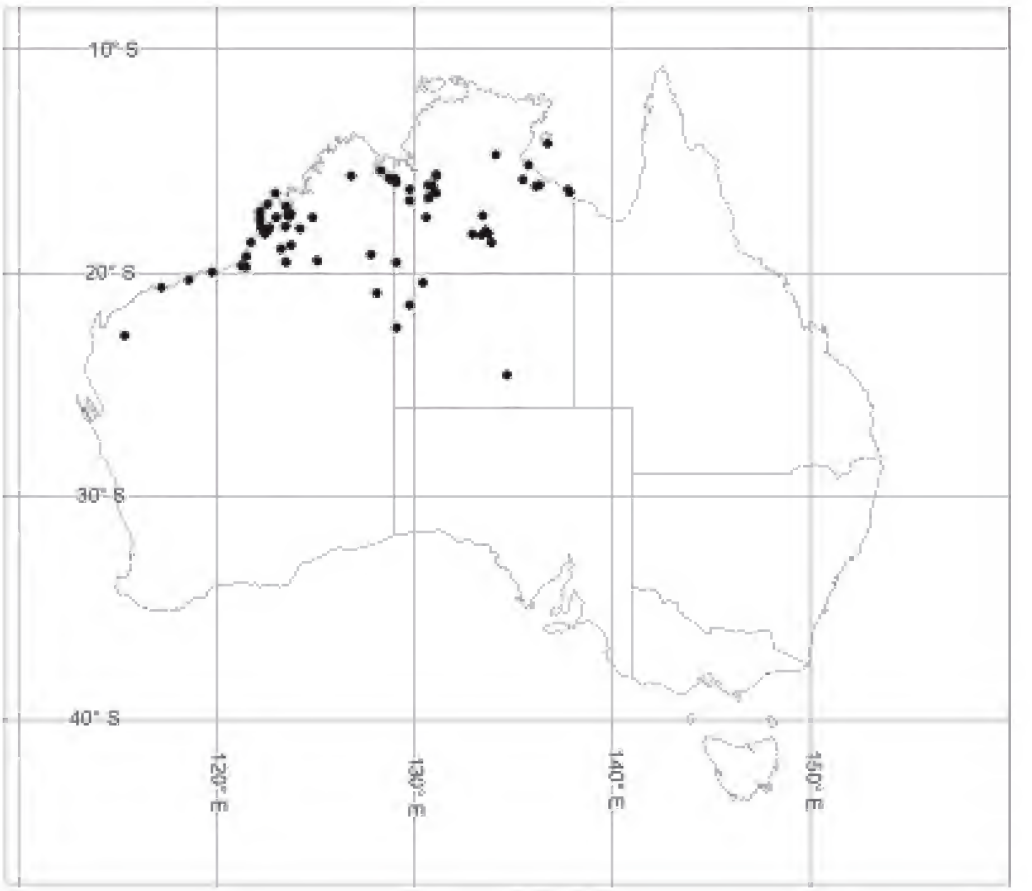
Crotalaria sturtii R.Br., in C. Sturt, Narr. Exped. C. Australia. Bot. App. 70. (1849) **Type:** On top of the ridges of pure sand, from S. lat. 28° to 26°, *C. Sturt s.n.* (holo: BM n.v. photo: BRI).

Crotalaria cunninghamii var. *trifoliolata* J.Black, Trans. R. Soc. S. Aust. 41: 651 (1917). **Type:** Strezlecki Creek, Sep 1916, *R.Cockburn & S.A.White* (holo: AD; photo: BRI).

***Illustrations*:** Hacker (1990: 113); Cunningham *et al.* (1981: 387); Jessop & Toelken (eds) (1986: 701, fig. 380a).

Leaves unifoliolate, rarely trifoliolate; petiole to 4.5 cm long. Racemes terminal, 5–35 cm long; flowers 20–52. Calyx lobes equal to or slightly longer than the tube. Keel petal 35–53 mm long.

***Selected specimens*: Western Australia.** Geikie Gorge, 16 km NE of Fitzroy Crossing, Jun 1970, *Briggs* 3668 (DNA, NSW, PERTH); Millstream Station, May 1952, *Brockway s.n.* (PERTH); 36 km W of Doorawarrah, May 1995, *Cranfield* 9689 (PERTH); Piccaninny Creek road, Bungle Bungle N.P., Apr 1956, *Solomon* 787 (PERTH); Gibb River road, 51 km NNE of Karunjie Stn, Jul 1991, *Streimann*



Map 3. Distribution of ***Crotalaria cunninghamii*** subsp. ***cunninghamii.***

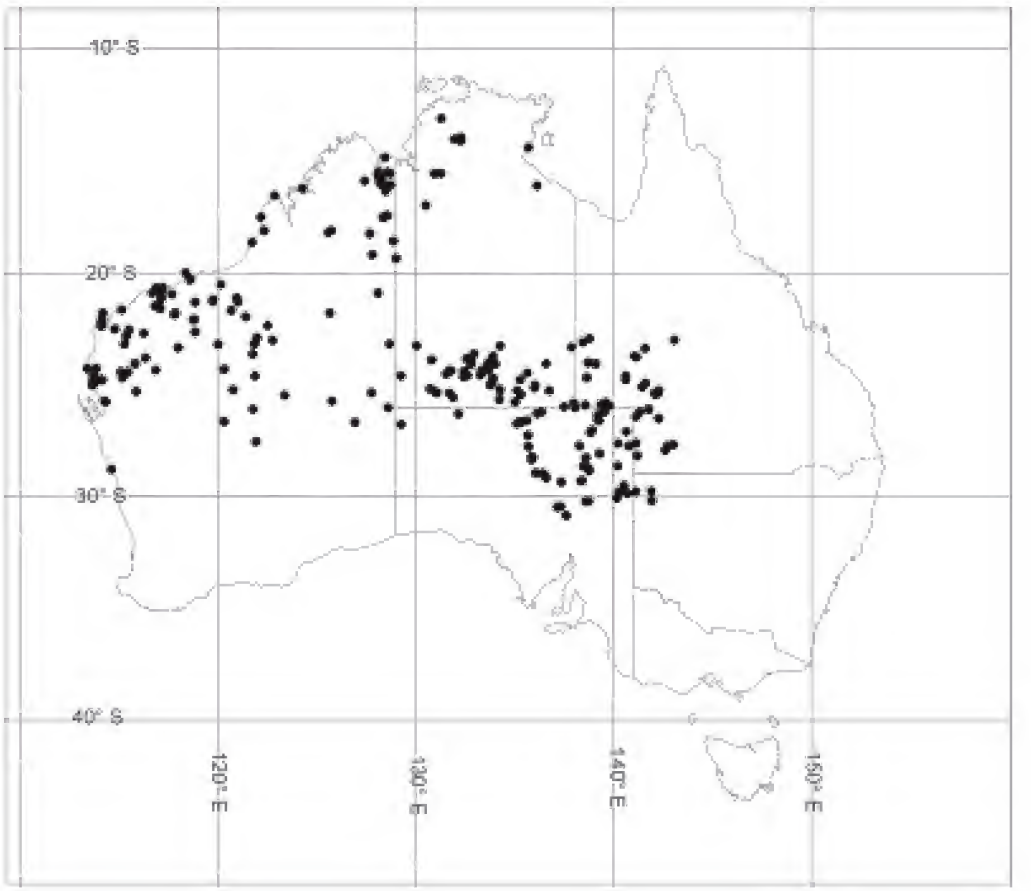
80027 (BRI, CANB, DNA). **Northern Territory.** 107 km from Tanami towards Gordon Downs, Aug 1971, *Gittins* 2385 (BRI); Hale River, Simpson desert, Aug 1977, *Latz* 7491 (DNA); *c.* 17 miles [27 km] NW of Andado Homestead, Jul 1968, *Must* 94 (AD, BRI, CANB, DNA). **South Australia.** Lake Cooragie, Innamincka Station, May 1966, *Smyth* 72 (AD); *c.* 8 km SW of William Creek, Sep 1986, *Weber* 9571a (AD, BRI); 40 km W of Hermannsburg, Jul 1954, *Chippendale* NT53 (DNA). **Queensland.** Gregory North District: 164 km from Windorah on Bedourie road, May 1997, *Forster* PIF 20610 *& Holland* (BRI, MEL, NSW); Mulligan River, 18 km SW of Glenormiston Homestead, Oct 1984, *Neldner* 1560 (BRI). Gregory South District: Birdsville, Jan 1937, *Everist* 76 (BRI); Nockatunga Station, Jun 1936, *Blake* 11803 (BRI, CANB). Warrego District: 80 miles [128 km] W of Thargomindah, Sep 1963, *Cockburn* 46 (BRI). **New South Wales.** Milparinka, Feb 1910, *Forster s.n.* (NSW).

***Distribution and habitat*:** Common throughout central Australia from Carnarvon in W.A. to Coopers Creek in Qld and as far south as Andamooka in S.A. Frequent on the crests of sand dunes, also found on sandy plains, and in drainage lines, on sandy soils. Map 4.

***Phenology*:** Flowers all year, often after rain.

***Discussion*:** Brown (1849) published these two names (*C. sturtii* and *C. cunninghamii*) on adjacent pages but gave greater prominence to the first name, *C. sturtii.* The type material of *C. sturtii* was collected from Central Australia. He described *C. cunninghamii* on the next page under "Obs" and distinguished it from *C. sturtii* by the "leaves simple, ovate to obovate, usually sericeous-tomentose, petiole apex curved, peduncle axillary, 1-flowered". The type material of *C. cunninghamii* was collected from north-western Australia.

Hooker (1852) and Mueller (1862) believed the two names to be synonymous but gave no published references. Hooker stated that "in many respects this (*C. cunninghamii*) accords with Mr. Browns description of *C. sturtii*". Mueller did not mention *C. sturtii* but his description of *C. cunninghamii* includes



Map 4. Distribution of ***Crotalaria cunninghamii*** subsp. ***sturtii.***

material with single and many-flowered racemes: "racemis ...elongatis raro ad florem solitarium reductis". Bentham (1864) placed *C. sturtii* in synonymy under *C. cunninghamii*: "The specimen of the latter (*C. cunninghamii*), and seen by R. Brown, having been imperfect as to inflorescence and there is nothing in R. Brown's diagnoses of *C. sturtii* which does not agree perfectly with the common state of *C. cunninghamii*".

Examination of current herbarium holdings revealed that a number of specimens from the north-west of Australia have short, few-flowered racemes. The remaining material, mostly from central Australia, has long, many-flowered racemes. Measurements of the lengths of the mature racemes of 476 specimens indicates 2 general groupings: racemes 0–3.5 cm long and racemes 5–31 cm long. On the basis of these measurements and other supporting characters, as well as the distribution of the groupings, I conclude that these taxa are for the most part distinct. *C. sturtii* is therefore here recombined at the level of subspecies.

The type specimen of *C. cunninghamii* var. *trifoliolata* J.Black is here considered to be a rare trifoliolate form of *C. cunninghamii* subsp. *sturtii.* No other trifoliolate specimens were seen. The existence of trifoliolate and unifoliolate forms in the same species, and sometimes on the same plant, has been noted in the literature for other legumes e.g. *Desmodium* (Pedley 1999) and *Cullen* (Grimes 1997).

***Lectotypification*:** The collections cited by Brown for *C. cunninghamii* are: **a.** North-west

coast of Australia (barren shores of Goodenough Bay, SE of Cygnet Bay, *A. Cunningham* (K, 3 specimens on one sheet); **b.** [Bynoe] *Wickham & Stokes'* Voyage of the Beagle (BM). The lower right hand specimen on the Kew sheet (sheet **a**.), is here selected as the lectotype.

8. Crotalaria dissitiflora Benth. in Mitch., J. Exped. Trop. Australia 386 (1848). **Type**: Baloon [Balonne] River, Nov 1846, *Mitchell* 459 (holo: K n.v.; photo: BRI, NSW).

Woody perennials to 60 cm; stem pubescent. Leaves trifoliolate; leaflets elliptic, lanceolate or obovate, 1–5 cm long, 0.5–1.5 cm wide, apex acute, obtuse or retuse; upper surface glabrous or pubescent; lower surface pubescent; petiole 1–3.5 cm long; stipules subulate, 0.5–6 mm long. Racemes terminal, to 26 cm long; flowers 3–30; bract and bracteoles lanceolate, 0.5–3.5 mm long, caducous; bracteoles inserted just below calyx; pedicel 1–4 mm long. Calyx 2.5–6 mm long, appressed pubescent; lobes ±equalling tube. Standard broadly ovate to suborbicular, apex rounded or emarginate, 6–15 mm long and wide, yellow, (with no other colours); wings oblong, shorter than or equalling keel; keel 7–17 mm long, beak not twisted. Pod shortly stipitate, oblong-clavate, oblique, 11–22 mm long, 4–8 mm wide, pubescent, with 6–12 seeds. Seed 2.5–3 mm long, brown or ochre.

Three subspecies are recognised here:

Key to subspecies of *Crotalaria dissitiflora* (adapted from Lee 1978):

1. Upper surface of leaflets always glabrous; keel 8–13 mm long **8a.** subsp. **dissitiflora**
 Both surfaces of leaflets pubescent; young leaflets usually bullate or rugose in appearance from arrangement of pubescence at veins

2. Keel beak 7–13 mm long **8b.** subsp. **rugosa**
 Keel beak 13–17 mm long **8c.** subsp. **benthamiana**

8a. Crotalaria dissitiflora Benth. subsp. **dissitiflora**

Illustrations: Hacker (1990: 114); Hardin (1994, 2: 521); Jessop (ed) (1981: 153 fig. 175d).

Plants sparsely pubescent, hairs appressed, to 0.5 mm long. Leaflet lamina 1–5 cm long, 0.6–1.2 cm wide, apex acute, obtuse or retuse; upper surface glabrous and minutely dotted; petiole 2–3.5 cm long; stipules 2.5–6 mm long. Bract 1–3.5 mm long; pedicel 2–3 mm long. Calyx 2.5–5 mm long. Keel petal 8–13 mm long, beak straight or rounded. Pod 1.1–1.6 cm long, 4–8 mm wide. Fig. 3D.

***Selected specimens*: Northern Territory.** 17 miles [27 km] W Arltunga, Mar 1958, *Chippendale* NT4080 (DNA, PERTH). S.A.: Congie sand hills, King's lookout, Oct 1986, *Conrick* 2017 (AD, HO); 5 miles [8 km] W Tarlton Downs Homestead, Feb 1968, *Latz* 158 (DNA, MEL); 12 miles [19.2 km] N Mittibar Homestead, Mar 1981, *Maconochie* 2598 (CANB, DNA). **Queensland.** Burke District: 35 miles [56 km] NNE Camooweal, May 1948, *Perry* 997 (CANB). Warrego District: Cunnamulla, Apr 1936, *Blake* 11212 (BRI, CANB); Gilruth Plains near Cunnamulla, Apr 1863, *McKee* 10313 (BRI, CANB, NSW). Leichhardt District: Peak Downs, Jun 1951, *Everist* 4405 (BRI, CANB); 82 km SW of Mt Coolon, Mar 1995, *Fensham* 2698 (BRI). **New South Wales**. Moree, Feb. 1969, *Mactier* (NSW).

Distribution and habitat: Occurs in southern Qld, N.S.W. and the southern part of the N.T., on heavy black clay soils, in open woodland and grassland. **Map**: Lee (1978: 330, Map 1).

Phenology: Flowers most of year.

8b. Crotalaria dissitiflora subsp. **rugosa** (Benth.) A.T.Lee, Telopea 1(5): 332 (1978); *Crotalaria dissitiflora* var. *rugosa* Benth., Fl. Austral. 2: 184 (1864). **Type**: Sturts Creek, Feb. 1886, *F.Mueller* (lecto, here designated: K, n.v.; photo: BRI, NSW; isolecto: MEL[MEL1010367]).

Illustration: Williams (1984: 90).

Plants moderately to densely pubescent, hairs loosely appressed, shining, to 2 mm long. Leaflet lamina 1–4 cm long, 0.5–1.3 cm wide, apex rounded or retuse; young leaflets usually bullate or rugose in appearance from arrangement of pubescence at veins; petiole

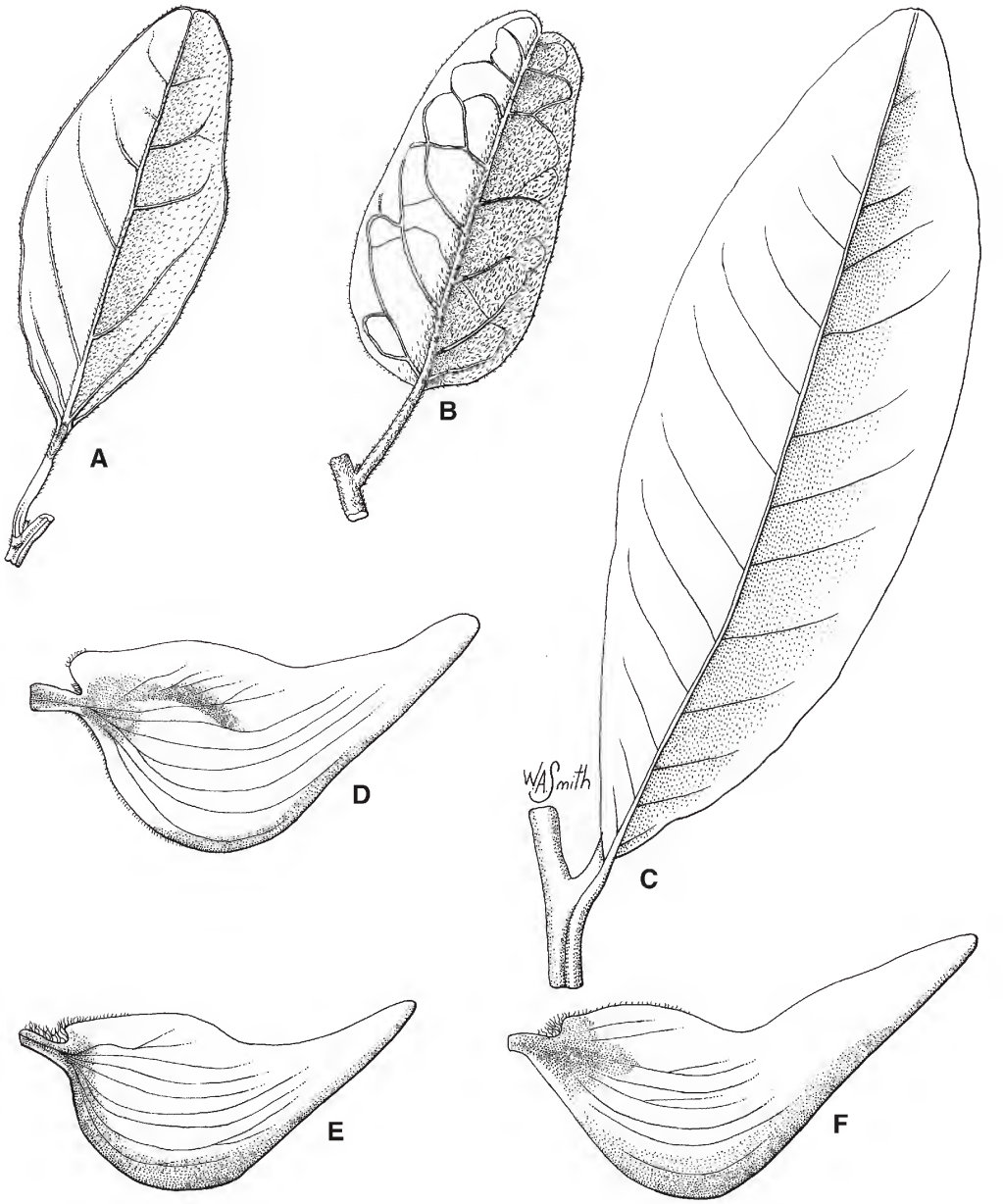


Fig. 3. A. ***Crotalaria novae-hollandiae*** subsp. ***novae-hollandiae***, leaf × 1. B. ***C. novae-hollandiae*** subsp. ***lasiophylla***, leaf × 1. C. ***C. novae-hollandiae*** subsp. ***crassipes***, leaf × 1. D. ***Crotalaria dissitiflora*** subsp. ***dissitiflora***, keel petal × 4. E. ***Crotalaria dissitiflora*** subsp. ***rugosa***, keel petal × 4. F. ***Crotalaria dissitiflora*** subsp. ***benthamiana***, keel petal × 4. A: *Purdie* 1036 (BRI). B: *Thomas* 662 (BRI). C: *Maconochie* 1591 (BRI). D: *Nelson* 2353 (CANB). E: *Kimbel* 48 (DNA). F: *Forrest s.n.* (MEL).

1.8–2.6 cm long; stipules linear, 0.5–5 mm long. Bract 0.5–2.2 mm long; pedicel 1–4 mm long. Calyx 3–4 mm long. Keel petal 7–13 mm long, beak straight or rounded. Pod 1.2–1.9 cm long, 4–8 mm wide. Fig. 3E.

Selected specimens: **Northern Territory**. Bishop's Bore, 17 miles [27 km] NW of Brunette Downs Homestead, Oct 1958, *Chippendale* NT5011 (BRI, DNA, PERTH); 30 miles [48 km] SW of Tobermorey Homestead, Sep 1954, *Chippendale* NT393 (BRI, CANB, DNA, NSW); 16 miles [25.6 km] E of Alcoota Stn, Mar 1953, *Perry* 3395 (BRI, DNA, CANB, PERTH); 1 km N of No. 11 Bore, Aug 1984, *Strong* 505 (DNA). **Queensland.** Burke District: 20 km N of Julia Ck, Mar 1977, *Pullen* 10.415 (BRI, CANB). Mitchell District: 15 miles [24 km] W of Hughenden on Richmond road, May 1956, *Burbidge* 5378 (CANB). Gregory North District: 110 km N of Birdsville, Sep 1951, *Pedley* 4478 (AD, BRI, MEL). **South Australia**. *c.* 30 km N of Innamincka, Jun 1986, *Archer s.n.* (AD).

Distribution and habitat: Tropical and subtropical Australia, from the Kimberley district of W.A., across the N.T., and in western Qld. Occurs on a variety of clay soils, usually in open woodland or grassland. **Map**: Lee (1978: 330, Map 1).

Phenology: Flowers most of year.

Lectotypification: Bentham (1864) cites two collections for var. rugosa: **a.** Sturt's Creek, *F.Mueller* (K, MEL [MEL1010367]) and **b.** Newcastle Water, *F.Mueller* (MEL [MEL1010366]). Specimen **a.** Sturts Creek, *F.Mueller* at K is here chosen as the lectotype. This specimen is the most complete of the two **a.** sheets and specimen **b.**

8c. **Crotalaria dissitiflora** subsp. **benthamiana** (Pritzel) A.E.Holland **comb. nov.**

Crotalaria benthamiana Pritzel in Diels & Pritzel, Bot. Jahrb. Syst. 35: 267 (1904); *Crotalaria dissitiflora* var. *grandiflora* Benth., Fl. Austral. 2: 184 (1864). **Type**: "Hammersley Range", F. Gregory's Expedition, *M.Brown* [MEL1010368] (neo, here designated: MEL photo: BRI).

Plants moderately to densely pubescent; hairs loosely appressed, shining, *c.* 2 mm long. Leaflet lamina 1.5–4 cm long, 0.5–1.4 cm wide, apex rounded; young leaflets usually bullate or rugose in appearance from arrangement of pubescence at veins; petiole 1–3 cm long; stipules 2–6 mm long. Bract 1–2 mm long; pedicel 2–4 mm long. Calyx 4–6 mm long; keel petal 13–17 mm long, beak straight. Pod 15–22 mm long, 6–7 mm wide. Fig. 3F.

Specimens examined: **Western Australia**. Port Hedland, Aug 1963, *Beard* 2861 (PERTH); Fortescue River, 1878, *Carey s.n.* (MEL); Between Port Hedland and Mt Tom Price, Mar 1970, *Donovan s.n.* (BRI); Jones Creek and George River south of Roebourne, undated, *Forrest* [MEL1727397] (MEL); Nickol River, 1878, *Forrest s.n.* (MEL); Between Onslow and Roebourne at Karratha Station, Dampier, Sep 1968, *Godlonton s.n.* (PERTH); Karratha Station, between Onslow and Roebourne, Oct 1968, *Fitzgerald s.n.* (PERTH); Wittenoom, on Port Hedland road, Jul 1964, *Garstone s.n.* (PERTH); Port Walcott, undated, *Harper s.n.* (PERTH); near Barowanna Hill, Mar 1984, *Newbey* 9966 (PERTH); 3 km S of Mt Florence Homestead, May 1996, *Mitchell* PRP1034 (BRI, PERTH); Port Hedland, 1973, *Stone s.n.* (PERTH).

Distribution and habitat: Known from the Fortescue district of W.A. with one specimen from Port Walcott. Occurs on "crabhole" plains of red basalt derived soil. **Map**: Lee (1978: 330, Map 1).

Phenology: Flowers February to October.

Discussion: Lee (1978) distinguished *C. benthamiana* Pritzel from *C. dissitiflora* Benth. by the large flowers (15–17 mm long) which have a straight-beaked keel (not incurved). This taxon is also geographically isolated and occurs on a distinct soil type, "red basaltic soils of the Pilbara". However, in her notes, Lee stated that "the status of this taxon is debatable; vegetatively it is indistinguishable from *C. dissitiflora* subsp. *rugosa* although their flowers are virtually constant and different from one another."

Recent collections of *C. dissitiflora* include specimens from both Qld and the N.T. which have larger flowers (keel 10–13 mm long). These large-flowered forms occur in both subspecies, and both of Lee's keel shapes are represented e.g. subsp. *dissitiflora*: rounded keel, *Perry* 997 (CANB); long, straight-beaked keel, *Maconochie* 2598 (CANB, DNA); subsp. *rugosa*: rounded keel, *Burbidge* 5378 (CANB); long, straight-beaked keel, *Strong* 505 (DNA).

Keel lengths were measured for 346 flowers from 75 specimens across all three taxa (including large flowered forms) yielding a continuous range of lengths from 7 to 17 mm.

Crotalaria benthamiana represents one end of the variation (fig. 3D–F) and is therefore here recombined at the level of subspecies.

***Neotypification*:** Pritzel described *C. benthamiana* as a new species but indicated in his notes that it was based on *C. dissitiflora* var. *grandiflora* Benth. Pritzel's designated type "in the tropical region on the shore of Nickol Bay midway to Spring Station" (B) is presumed destroyed. Lee (1978) selected a lectotype for *C. benthamiana* from among Bentham's *C. dissitiflora* var. *grandiflora* syntypes. However, none of these specimens were actually cited by Pritzel. Therefore neotypification, rather than lectotypicification is required. In order to avoid further confusion, I here designate Lee's "lectotype": Hammersley Range, F. Gregory's Expedition, M.B. (MEL [MEL1010368]) as the neotype for *C. benthamiana*.

9. Crotalaria novae-hollandiae DC., Prod. 2: 127 (1825). **Type:** "in Nova-Hollandia orient" (G-DC n.v. [fiche: BRI]).

Perennial herbs or shrubs to 2 m; stem pubescent. Leaves unifoliolate; lamina broadly elliptic to narrowly oblong, 2–17 cm long, 0.5–8 cm wide, apex acute, obtuse or retuse; upper surface glabrous or pubescent; lower surface pubescent; petiole 5–20 mm long; stipules lanceolate, 1–5 mm long. Racemes to 35 cm; flowers 5–50; bract lanceolate, 1–4 mm long; bracteoles *c.* 1 mm long, inserted on the pedicel near the middle; pedicel 2–11 mm long. Calyx 4–8 mm long, appressed pubescent; lobes triangular, shorter or longer than tube. Standard ovate, obovate or suborbicular, 7–18 mm long, yellow, veins reddish-brown; wings equal to or shorter than keel; keel 8–16 mm long, beak twisted. Pod stipitate, oblong-clavate, 17–36 mm long, 4–14 mm wide, glabrous or pubescent; seeds 6–10. Seed 3.5–6 mm long, yellow-brown.

Three subspecies are recognised here.

Key to subspecies are *Crotalaria novae-hollandiae*

1. Whole plant glabrous, often glaucous; petioles 2–8 mm long; ridged, ridge decurrent; flowers 5–20; calyx lobes slightly longer than tube **9c.** subsp. **crassipes**
 Plants pubescent at least on stem, petioles and peduncles; petiole 6–20 mm long, not ridged or decurrent; flowers 10–50; calyx lobes longer or shorter than tube

2. Both surfaces of leaflet lamina densely pubescent, hairs often ferruginous; base rounded or cordate; veins forming an angle of 70°–90° to the midrib; bracteoles inserted at or above the midpoint of the pedicel **9b.** subsp. **lasiophylla**
 Upper surface of leaflet lamina pubescent or glabrous; lower surface appressed pubescent, hairs usually white; base rounded to cuneate, apex variable; veins forming an angle of 30°–60° to the midrib; bracteoles on lower half of pedicel **9a.** subsp**. novae-hollandiae**

9a. Crotalaria novae-hollandiae DC. subsp. **novae-hollandiae**

Illustrations: Hacker (1990: 121); Wheeler *et al.* (eds) (1992: 389, fig. 116a); Williams (1984: 90).

Plants to 1.5 m; stem pubescent. Leaflet lamina elliptic, ovate, obovate, lanceolate or oblong, 3–13 cm long, 0.5–4 cm wide, apex acute, obtuse or retuse, base rounded or cuneate; upper surface glabrous, or both surfaces appressed pubescent; veins forming an angle of 30°–60° from the midrib; petiole 6–20 mm long, not ridged or decurrent. Racemes to 33 cm; flowers 10–50; bracteoles inserted on lower half of pedicel. Calyx 4–6.5 mm long; lobes equal to or shorter than tube. Standard 7–18 mm long; keel 8–15 mm long. Pod glabrous or sparsely pubescent. Seed 3.5–5 mm long. Fig. 3A

***Selected specimens*: Western Australia.** Mable Downs, May 1984, Winnama Spring, 17.5 km S of Turkey Creek, May 1984, *Forbes* 2011 (BRI, CANB, MEL, PERTH); Bungle Bungle N.P., Osmond Ck, W of Osmond Yard, June 1989, June 1989, *Menkhorst* 399 (DNA, PERTH); Miles Bore, Feb 1992, *Mitchell* 2064 (DNA, PERTH). **Northern Territory**. 30.2 miles [48 km] S of Katherine, Sept 1957, *Chippendale* 3738 (AD. CANB, DNA, PERTH, MEL); 22

miles [35.5 km] NNE of New Tanumirini Homestead, June 1971, *Latz* 1400 (CANB, DNA); 16 miles [25.6 km] E Tarlton Downs, Apr 1967, *Maconochie* 109 (CANB, DNA); 2 miles [3.2 km] N of Katherine, Feb 1961, *McKee* 8526 (CANB, DNA, NSW); Great Northern Highway, 27 km N of Turkey Creek, Apr 1987, *Purdie* 3312 (CANB, MEL. **Queensland.** Burke District: Mica Creek, Mt Isa, Oct 1967, *Braithwaite* 3335 (CANB); 6 miles [9.6 km] S of Boomarra Station, Aug 1953, *Perry* 3985 (BRI, CANB, DNA, PERTH).

Distribution and habitat: Northern Australia, from the Dampier Peninsula in W.A., throughout the N.T., and in northern Qld. Occurs in woodland, shrubland and grassland, on a variety of soil, often near streams or rivers. Map: Lee (1978: 349: Map 3).

Phenology: Flowers all year.

9b. Crotalaria novae-hollandiae subsp. **lasiophylla** (Benth.) A.T.Lee, Telopea 1(5): 19–356 (1978); *Crotalaria novae-hollandiae* f. *lasiophylla* Benth., Fl. Austral. 2: 182 (1864). **Type:** "near Mt. Humphries", *McDouall Stuart* [MEL1010378] (lecto: MEL, fide Lee (1978); photo: BRI).

Illustrations: Wheeler *et al.* (eds) (1992: 389, fig. 116b); Jessop & Toelken (eds) (1986: 701 fig. 380a).

Plants to 1.5 m; stem pubescent. Leaflet lamina elliptic, ovate or obovate, 2–10 cm long, 1–4.5 cm wide, apex obtuse or retuse, base rounded or cordate; both surfaces densely pubescent, usually with ferruginous hairs; veins having an angle of 70°–90° to the midrib; petiole 4–17 mm long, not ridged or decurrent. Racemes to 24 cm; flowers 10–35; bracteoles usually inserted at or above the midpoint of the pedicel. Calyx 6–7 mm long; lobes, equal to or shorter than tube. Standard 9–17 mm long; keel 8–15 mm long. Pod pubescent. Seed 3.5–5 mm long. Fig. 3B

Selected specimens: **Western Australia**. Near Frog Bore, Bohemia Downs, Apr 1972, *Aplin* 4754 (AD, CANB, MEL, PERTH); Taylor's Lookout, 40 km S Lamboo Homestead, Oct 1972, *Aplin* 5209 (PERTH); Fitzroy River, Apr 1953, *Gardner* 10153 (AD, CANB, MEL, PERTH); Just W of Wolf Creek Crater, Apr 1979, *George* 15307 (CANB, DNA, PERTH). **Northern Territory**. 15.4 miles [24 km] E of The Granites, Nov 1965, *Chippendale* NT4275 (AD, DNA, MEL); Pingelly Waterhole, Kurundi Station, Feb 1972, *Dunlop* 2490 (DNA, CANB); 6 miles [9.6 km] S Alice Springs, Dec 1969, *Nelson* 1985 (AD, DNA, MEL); Lenners Rock, 1 mile [1.6 km] N, Nov 1954, *Winkworth* 34 (BRI, CANB, MEL, PERTH). **Queensland**. Burke District: 8.3 km E Mussellbrook Mining Camp on main southern road to Camooweal 175 km N of Camooweal, May 1995, *Johnson* MRS979 (BRI); 0.6 miles [0.8 km] N of Deep Well Siding, Aug 1964, *Nelson* 1270 (CANB, DNA, PERTH); Gregory River Crossing *c.* 20 miles [32 km] SW of Burketown, Jun 1966, *Pedley* 2067 (BRI, CANB). **South Australia**. 1 km from Purni Bore, Jul 1984, *Badman* 1350 (AD, CANB); Sand dune adjacent to Purnie Bore & 56 km E of Dalhousie Springs, Sept 1974, *Symon* 9408 (AD, CANB).

Distribution and habitat: Throughout the N.T. and adjacent areas of W.A. and Qld, and the northern edge of S.A. Occurs in open woodland, shrubland or grassland, in sandy soil. Map: Lee (1978: 349: Map 3).

Phenology: Flowers September to December.

9c. Crotalaria novae-hollandiae subsp. **crassipes** (Hook.) A.E.Holland **comb. nov.**

Crotalaria crassipes Hook. in Hooker's *Icon. Pl.* 9: t. 830 (1852). **Type**: N.W. coast, *Bynoe* (holo: K; photo: BRI).

Illustrations: Hooker (1952: 8, t.830)

Plants to 2 m, glabrous, often glaucous. Leaf lamina 5–17 cm long, 2–8 cm wide, apex variable, base rounded to cuneate; upper surface pubescent or glabrous, lower surface appressed pubescent, hairs usually white; veins forming an angle of 30°–60° to the midrib; petiole 2–8 mm long, ridged and decurrent. Racemes to 35 cm long; flowers 5–20; bracteoles inserted on lower half of pedicel. Calyx 6–8 mm long; lobes slightly longer than tube. Standard 12–18 mm long; keel 12–16 mm long. Pod glabrous. Seed 4–6 mm long. Fig. 3C.

Selected specimens: **Western Australia.** 11.5 km by road N of Kalumburu on road to Pago Mission, May 1985, *Aplin* 890 *et al.* (PERTH); Wanjana N.P., Aug 1982, *Conrick* 1082 (AD); Charnley River, 4 km upstream of junction with Calder River, May 1983, *Dale* 5 (PERTH); Leopold Range, Gibb River road, W.A., Nov 1981, *Dunlop* 6020 & *Done* (DNA, MEL, PERTH); Mellarie Creek, 5 km N Drysdale Homestead where Gibb River road crosses this creek, Jun 1992, *Mitchell* 2577 (DNA, PERTH); Kuri, S end of peninsula, Vansittart Bay, Mar 1993, *Mitchell* 2925 (CANB, PERTH); 14 km N Napier Range, May 1975, *Symon* 10139 (AD, CANB, PERTH); Heywood Island, May 1972, *Wilson* 10897 (PERTH). **Northern Territory.** 6 km W Mitchell River Falls, Apr 1993, *Cowie* 4355 & *Brubacker* (CANB, DNA, MEL); Mount Brockman, Apr 1980, *Dunlop* 5500 (CANB,

DNA); Mudginberri Station, May 1982, *Dunlop* 6162 & *Taylor* (DNA, MEL); between Cahill's Crossing and Oenpelli, May 1973, *Hartley* 13728 (CANB, DNA); Narbarlek, Apr 1988, *Hinz* 4 (BRI, CANB); 7 miles [11 km] E Rum Bottle Creek, Jun 1972, *Maconochie* 1591 (BRI, CANB, DNA); Kakadu N.P., 6 km SW Mount Brockman, Apr 1980, *Telford* 8066 & *Wrigley* (CANB); Gregory N.P., Apr 1996, *Walsh* 4516 (MEL); 27 km E Goomadeer Crossing, Arnhem Land, Jun 1987, *Wightman* 3823 (DNA).

***Distribution and habitat*:** Coastal areas in northern and western Australia from the Kimberley district in W.A. and as far east as the Calvert River in the N.T. Occurs in open woodland and grassland, on slopes, creek banks and sand dunes, in sandy soils. Map: Lee (1978: 349: Map 3).

***Phenology*:** Flowers from February to October.

***Discussion*:** *C. crassipes* was first described by Hooker in 1851 as a "most distinct and well marked species" based on material collected on the north-west coast of Australia. Bentham (1864) retained this species, distinguishing it from the closely related *C. novae-hollandiae* by the total lack of hairs, the subulate stipules and the decurrent petiole-ridges. Lee (1978) disagreed with this distinction because "...the few specimens seen by me differ from *C. novae-hollandiae* only in being glabrous." She placed *C. crassipes* in synonomy under *C. novae-hollandiae*.

With further material now available it is evident that *C. crassipes* is, for the most part, distinct, distinguished by the absence of hairs, the petiolar ridges and shorter petiole (fig. 3A–C). However, there are a number of intermediate forms from the Northern Territory: **a.** glabrous and nearly glabrous specimens of *C. novae-hollandiae* subsp. *novae-hollandiae*: between the Calvert River and Calvert Hills Station, May 1974, *Pullen* 9243 (CANB, DNA), 3 miles [4.8 km] W of Calvert River Crossing, May 1974, *Carolin* 9257 (NSW) and **b.** specimens of *C. novae-hollandiae* subsp. *lasiophylla* which have petiole-ridges and short petioles: King Ash Bay, McArthur River, May 1984, *Thomson* 678 (DNA), Davenport Range, Old Elkedra Homestead, May 1977, *Latz* 6977 (CANB, NSW). *C. crassipes* is therefore here recombined at the level of subspecies.

10. Crotalaria montana Heyne ex Roth, Nov. Pl. Sp. 335. 1821.Type: East India, *Heyne s.n., Wallich* 5384 (syn: K, n.v. (photo at BRI)).

Crotalaria linifolia auct. non L.f.: Bentham (1864, 180); Bailey (1900, 373); Stanley & Ross (1983, 275) (see discussion below).

Erect annual or perennial herb to 1 m; stem appressed pubescent or subglabrous. Leaves simple, narrowly oblong or linear, 20–80 mm long, 2–7 mm wide, L:W ratio 5–24:1, apex acute or obtuse; upper surface glabrous or both surfaces shortly appressed-pubescent; petiole to 2 mm long; stipules absent. Racemes 10–60 cm long; flowers 7–35; bract and bracteoles linear, 1.5–2.5 mm long; bracteoles inserted on the calyx; pedicel 2–5 mm long. Calyx 5–7 mm long, somewhat 2-lipped, pubescent; upper lobes joined nearly to apex. Corolla equalling the calyx; standard suborbicular, emarginate, 4.5–7 mm long, 3–6 mm wide, auriculate, pale yellow, veins reddish; outer surface pubescent on midrib; wings oblong, 4–7 mm long, equal to or shorter than keel; keel 5–7.5 mm long, 2.5–3.5 mm wide, beak twisted. Pod sessile, subglobose to cylindrical, 5–12 mm long, 4–5 mm wide, glabrous; seeds 8–16. Seed 1.3–2.7 mm long, black, brown or yellow-green.

Two varieties are recognised for Australia here.

Key to varieties of *Crotalaria montana* in Australia

Pod 5–8 mm long **10a.** var. **angustifolia**
Pod 8–12 mm long **10b.** var. **exserta**

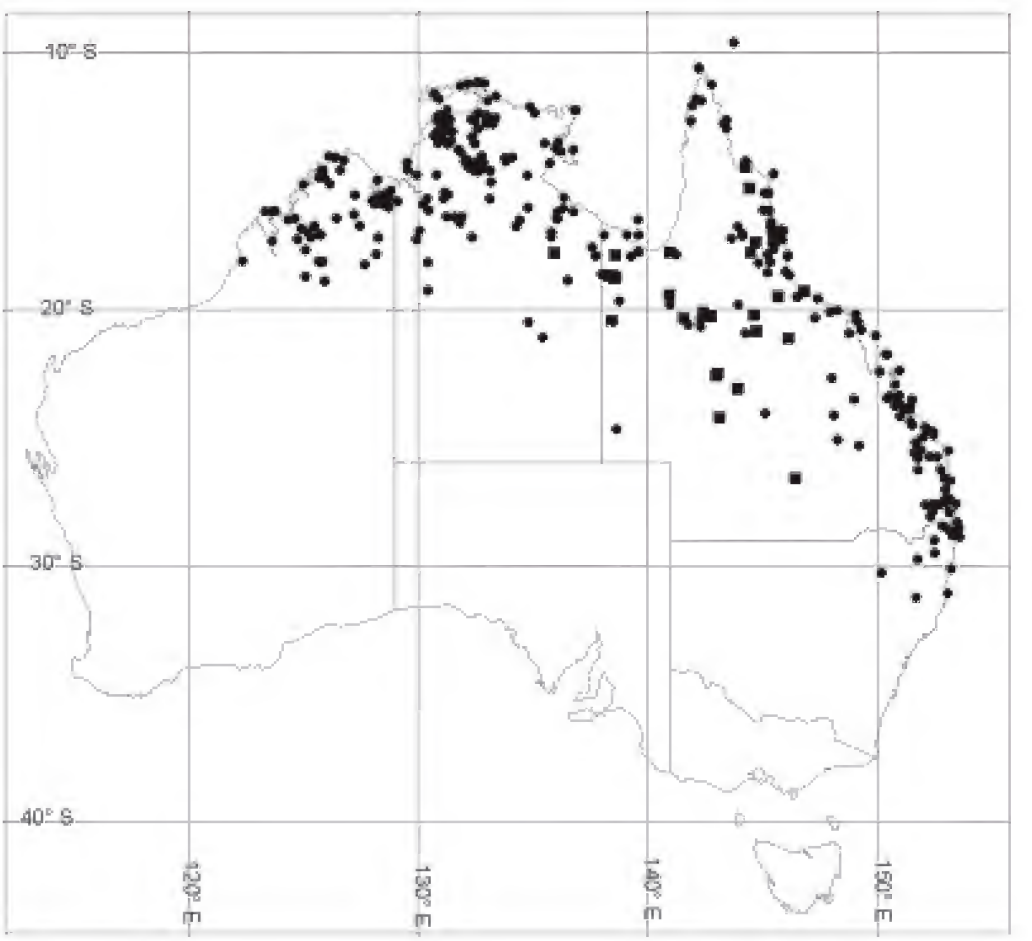
Note: *C. montana* var. *montana* does not occur in Australia - see discussion below.

10a. Crotalaria montana var. **angustifolia** (Gagnep.) Niyomdham, Thai For. Bull. Bot. 11: 145 (1978); *Crotalaria linifolia* L.f. var. *angustifolia* Gagnep., Fl. Gen. I.-C. 2: 332 (1916). **Type**: *Mieville* in *Chevalier* 37225 (holo: P, n.v.; photo: BRI).

Racemes 4–30 cm long. Pod subglobose to rhomboid, 5–8 mm long, slightly longer than the calyx. Fig. 2A,B.

***Selected specimens*: Western Australia.** 19 km SE of East Wyndham, Kununurra road, Jul 1974, *Carr* 3236 & *Beauglehole* (CANB, PERTH); Mabel Downs, Winnama Gorge, 17.5 km S Turkey Creek, May 1984, *Forbes* 1987 (MEL, PERTH); Upper slopes of Cockburn Range, Mar 1978, *Hartley* 14605 (CANB, PERTH); 4 km SE of Beverley Springs Homestead, May 1979, *Muir* 651 (PERTH); 6 km S of Wyndham on road to Halls Creek, Apr 1977, *Pullen* 10.871 (CANB, PERTH); Christmas Creek Station, May 1962, *Royce* 6994 (CANB, PERTH); Koolan Island, Apr 1984, *Vernon* 50 (CANB, PERTH). **Northern Territory.** 2.5 miles [4.0 km] SW of Fountain Head, Mar 1061, *Chippendale* NT7696 (BRI, CANB, DNA, MEL, PERTH); Cobourg Peninsula, Popham Bay, Apr 1993, *Cowie* 3608 (DNA); 1 km N Borroloola, Mar 1979, *Henshall* 2659 (CANB, DNA); 75 miles [120 km] NE of Maraboy Police Station, Mar 1965, *Lazarides* 86 & *Adams* (CANB, DNA); 64 miles [102 km] NE of Tanami Bore, May 1971, *Maconochie* 1110 (AD, BRI, CANB, PERTH); Humpty Doo, Feb 1961, *McKee* 8304 (CANB, DNA, NSW); Limbunya Station, Base Camp, Jul 1949, *Perry* 2330 (BRI, CANB, DNA, MEL); Bickerton Island, South Bay, Jun 1948, *Specht* 538 (AD, BRI, CANB, MEL, NSW, PERTH). **Queensland.** Burke District: Nicholson River crossing, Doomagee, May 1974, *Jacobs* 1440 (CANB, NSW). Cook District: 21 km W of Cholmondeley Creek crossing on Telegraph Line road towards Skardon River, Mar 1992, *Johnson* 5165 (BRI, MEL). North Kennedy District: Burdekin River area above Dalbeg, Apr 1975, *Staples* 2108 (BRI). Leichhardt District: Carnarvon Gorge, 70 miles [112 km] NNW of Injune, Apr 1966, *McDonald* 211 (BRI). Mitchell District: 34 miles [54 km] NW of Longreach, Mar 1953, *Davidson* 346 (BRI). Burnett District: 14 km from Murgon, towards Nanango, Nov 1996, *Bean* 11381 (BRI, NSW). Darling Downs District: 6 km E of Maryvale, Mar 1995, *Fensham* 1960 (BRI). Moreton District: Serpentine Creek & environs, 11 km NE of Brisbane, Mar 1973, *Durrington* 515 (BRI). **New South Wales.** Mount Sugarloaf, July 1969, *Clarke* 1830 (NSW); Kyogle to Woodenbong, Jan 1971, *Salasoo* 4574 (NSW).

***Distribution and habitat*:** Across northern Australia from Broome in W.A., through the northern half of the N.T., throughout Qld, and in northern N.S.W. Also in SE Asia and New



Map 5. Distribution of ***Crotalaria montana*** var. ***angustifolia*** ● and ***Crotalaria montana*** var. ***exserta*** ■.

Guinea. Occurs in grassland and woodland in a variety of soils and situations. Map 5.

Phenology. Flowers December to September.

10b. Crotalaria montana var. **exserta** (Domin) A.E.Holland, **comb. nov.**

C. exserta Domin, Biblioth. Bot. 89 (2): 179 (1925). **Type**: Queensland: "in xerodrymio ad pedem montis Metal Mountains, apud opp. Chillagoe", Feb 1910, *K.Domin* (lecto, here designated: PR [PR527125]; photo: BRI)

Racemes 10–60 cm long. Pod cylindrical, nearly twice the length of the calyx, 8–12 mm long. Fig. 2C.

***Selected specimens*: Queensland.** BURKE DISTRICT: 8 km N of Riversleigh Homestead, Jun 1974, *Maconochie* 1943 (BRI, DNA); Lawn Hill N.P., Louie Creek, Apr 1997, *Forster* PIF 20854 & *Holland* (BRI, DNA); Ridgepole Waterhole, 27 km E Musselbrook Mining Camp, Apr 1995, *Johnson* MRS240 & *Thomas* (BRI); Canobie, *c.* 100 miles [160 km] NNE of Cloncurry, Apr 1954, *Everist* 5323 (BRI); 1.5 km NW of Magazine Hill, 10.4 km N of Siver Star Mine, Apr 1991, *Jones s.n.* (BRI); 35 km N of Julia Creek on the Normanton road, Mar 1977, *Pullen* 10.424 (BRI, CANB); Barkly Downs, May 1963, *Gittins* 789 (BRI); 84 km NE of Hughenden, 17 km NNW of Clyde Park Homestead, Mar 1993, *Thompson* HUG212 & *Henderson* (BRI). COOK DISTRICT: Gilbert River, undated, *Bick s.n.* (BRI); Eight Mile Swamp Area, Lakefield N.P., Jan 1993, *Bean* 5541 (BRI); 4 km E of Almaden on road to Petford, Mar 1980, *Clarkson* 3044 (BRI, DNA, PERTH); 73 km from Almaden on road to Mount Surprise, Jan 1992, *Forster* 9633 (BRI, MEL). NORTH KENNEDY DISTRICT: Snake Creek, *c.* 95 km NW of Charters Towers on Gregory Developmental road, Apr 1991, *Batianoff* SC9104009 & *Franks* (BRI); 30 miles [48 km] S of Townsville on western line, Mar 1964, *Robinson s.n.* (BRI). SOUTH KENNEDY DISTRICT: 4 km SW of Natal Downs, Jun 1991, *Thompson* 141 *& Henderson* (BRI). MITCHELL DISTRICT: Bald Hills Creek, Windgate Parade, Valetta, May 1991, *Emmott* 463 (BRI); 14 km NE of Prairie on edge of Flinders Hwy, Mar 1993, *Thompson* HUG293 & *Henderson* (BRI).

***Distribution and habitat*:** Occurs in Queensland in the north-west and on Cape York Peninsula, as far south as Townsville, in grassland or open woodland with grassy understorey, on clay or clay loam soils near creeks and watercourses. This variety appears to be restricted to Australia. Map 5.

***Phenology*:** Flowers and fruits January to June.

***Discussion*:** *Crotalaria montana* and C. *linifolia* L. are closely related and both names appear in the Australian literature. According to Verdcourt (1979), the Australian material is correctly identified as *C. montana.* Rudd (1991) distinguished the two species in Sri Lanka by flower length: *C. linifolia* has flowers *c.*10 mm long and *C. montana* has flowers *c.* 7 mm long. Examination of photographs of the type material of *C. linifolia* confirms that the flowers are *c.* 10 mm long, longer than that of any Australian material. I conclude therefore that *C. linifolia sens. str.* does not occur in Australia.

Niyomdham (1978) described two varieties of *C. montana* for Thailand: **a.** var. *montana* which has calyx and standard limb 8–9 mm long, and **b.** var. *angustifolia* which has calyx and standard limb 5–7 mm long. According to this taxonomy, the Australian material is correctly identified as *C. montana* var. *angustifolia.*

The name *Crotalaria exserta* Domin was never adopted but a distinct taxon fitting Domin's (1925) description occurs in Queensland. According to Domin, *C. exserta* differs from *C. linifolia* (*C. montana*) "mainly in the pod which is twice the length of the calyx". A number of robust specimens from north-west Queensland have pods more than 8 mm long but in other respects these resemble those of *C. montana*. Specimens with smaller pods, 6–8 mm long, also occur in this area. Pod lengths from 131 specimens were measured. *C. exserta* represents one end of the variation noted and is therefore here recognised as a variety of *C. montana*.

***Lectotypification*:** Domin cited two collections in his protologue: **a.** "Mount Remarkable, apud. opp. Pentland", Mar 1910, *K.Domin* (PR[PR527124]), and **b.** "in xerodrymio ad pedem montis Metal Mountains, apud opp. Chillagoe", Feb 1910, *K.Domin* (PR[PR527125]). Specimen **b.**, which is more complete, is here chosen as the lectotype.

Section D: New taxa

11. Crotalaria medicaginea Lam., Enc. 2: 201 (1786). **Type**: East India, *Sonnerat* (holo: P-La., n.v.; photo: BRI).

Crotalaria trifoliastrum auct. non Willd.:

Bentham (1864, 183); Bailey (1900, 375) (see discussion below).

Annual or perennial herbs to 1 m; stem pubescent. Leaves trifoliolate; leaflets obovate, oblanceolate or linear, 5–60 mm long, 0.5–10 mm wide, apex obtuse, truncate or emarginate; upper surface glabrous; lower surface sparsely pubescent; petiole 1–15 mm long, shorter than leaflets; stipules linear-lanceolate, 1–5 mm long. Racemes to 35 cm long; flowers 4–40; bract linear-lanceolate, 1–2.5 mm long; bracteoles 0.3–1.5 mm long, inserted on the pedicel; pedicel 1–5 mm long. Calyx 2–4 mm long, appressed pubescent; lobes triangular, slightly longer than tube. Standard ovate, obovate or suborbicular, acute or rounded, 3–8 mm long, 2.5–7 mm wide, yellow, veins reddish; wings oblong, 3–7 mm long, shorter than keel; keel 3–8 mm long, beak twisted. Pod sessile, subglobose to rhomboid, 3–5.5 mm long and wide, appressed-pubescent, beak *c.* 1 mm long; seeds 2. Seed 1.5–2.5 mm long, olive-brown or yellow.

Three varieties are recognised here.

Key to varieties of *Crotalaria medicaginea*

1. Leaflets 0.5–3 mm wide, L:W ratio 13–35:1 **11c.** var. **linearis**
 Leaflets 1–10 mm wide, L:W ratio 2–15:1 2

2. Plants ascending, to 30 cm; calyx 2–3 mm long; keel 3–4.5 mm long; pod 3–4 mm long **11a.** var. **medicaginea**
 Plants mostly erect, to 1 m; calyx 2.5–4 mm long; keel 4–7.5 mm long; pod 4–5.5 mm long **11b.** var. **neglecta**

11a. Crotalaria medicaginea var. **medicaginea**

Illustration: Niyomdham (1978: 174, fig. 11, B1)

Ascending herb to 30 cm high; much branched from near base. Leaflet lamina obovate to oblanceolate, 5–20 mm long, 2–8 mm wide, L:W ratio 2–6:1, apex obtuse, truncate or emarginate; stipules 1–2 mm long. Racemes to 9 cm long; bract 1–2 mm long; bracteoles 0.5–1 mm long; pedicel 1–2 mm long. Calyx 2–3 mm long. Standard ovate, acute, 3–4.5 mm long, 2.5–3.5 mm wide; keel 3–4.5 mm long. Pod 3–4 mm long.

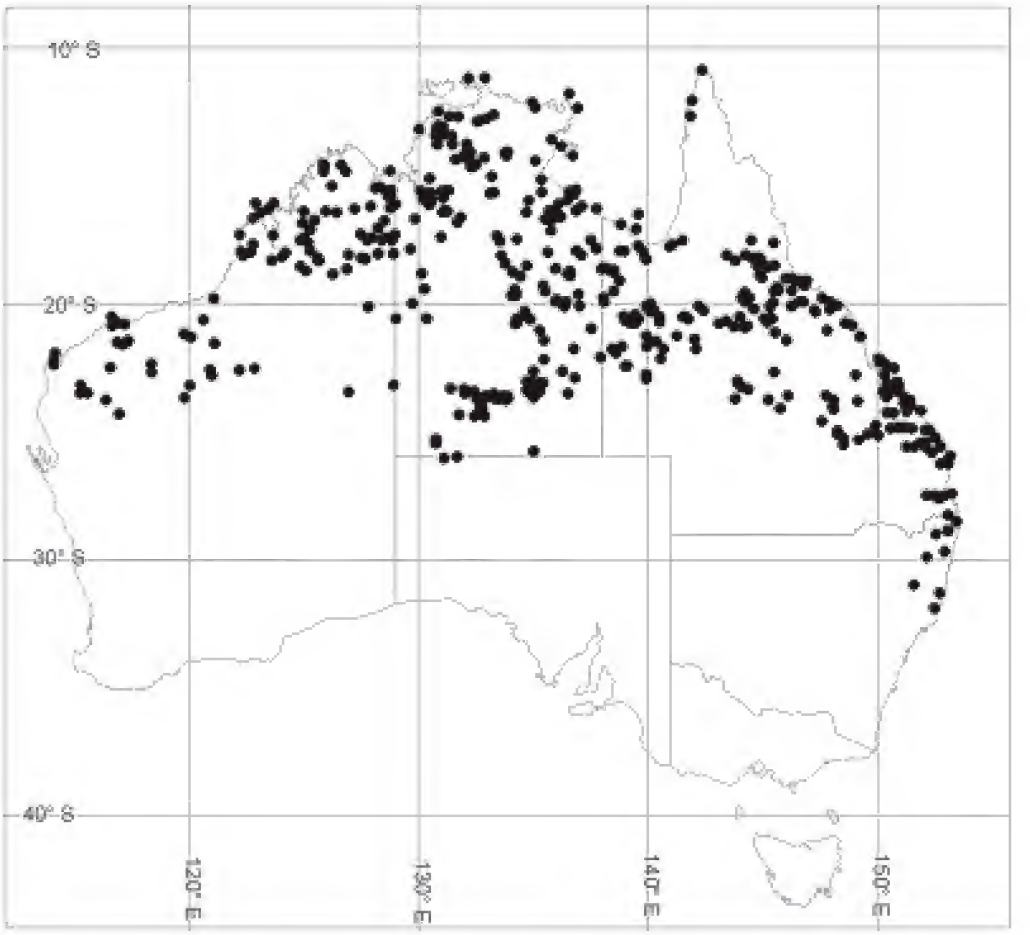
***Selected specimens*: Western Australia.** Gibb River road, *c.* 8 km S of turnoff to Mount House Station, May 1985, *Aplin 1013 et al.* (PERTH); **Northern Territory.** Katherine Gorge, Jun 1970, *Briggs* 3689 (NSW); Cotton Island, May 1988, *Cowie* 2975 (DNA); Port Essington, West Bay, Apr 1993, *Cowie* 3426 (DNA); Blue Mud Bay, Benyella, May 1993, *Dunlop* 9439 & *Leach* (DNA); Eva Valley Station, Mar 1991, *Evans* 3640 (DNA); Melville Island, Apr 1986, *Johnson* 4182 (BRI); South Alligator River, 180 km E of Darwin, May 1974, *Pullen* 9415 (CANB); Little Lagoon, Groote Eylandt, Apr 1948, *Specht* 250 (AD, BRI, MEL, NSW); Port Bradshaw, Jul 1948, *Specht* 707 (AD, BRI, MEL, NSW); Delissaville, Cox's Peninsula, Mar 1948, *Specht* 136 (AD, BRI). **Queensland.** Cook District: Lockerbie 10 miles [16 km] WSW of Somerset, Apr 1948, *Brass* 18382 (BRI, CANB); *c.* 4.2 km SW of Herberton on Silver Valley road, May 1983, *Conn* 1167 & *Clarkson* (BRI, MEL); 11.1 km S of Batavia Downs on Peninsula Development road, Apr 1990, *Clarkson* 8287 & *Neldner* (BRI, NSW); Walsh River crossing c. 11 km NW of Rookwood Homestead, Jun 1983, *Conn* 1337 & de *Campo* (BRI, CANB, MEL, NSW); Yorkey's Knob Beach, near Cairns, Apr 1962, *McKee* 9015 (BRI, NSW); Mappoon, near mouth of Wenlock River, Aug 1990, *Waterhouse* BMW 1142A (BRI). North Kennedy District: Junction of Cooloomon and Little Cooloomon Creeks, May 1962, *Whitehouse s.n.* (BRI); SFR 461 c. 5 km NW of Cardwell, W of Mount Elphinstone, May 1976, *Thorsborne* 209 & *Thorsborne* (BRI). South Kennedy District: Myrtle Creek, near Proserpine, undated, *Michael* 1166 (BRI); Bowen, Mar 1999, *Forster* PIF 24199 & *Booth* (BRI).

***Distribution and habitat*:** Northern Australia, from the W.A. coast, across the top of the N.T. and on Cape York and the east coast of Qld as far south as Bundaberg. Occurs mainly on the coast and islands, in open eucalypt forests, woodlands and grasslands and on coastal dunes, in a variety of soils. Map 6.

***Phenology*:** Flowers and fruits February to September.

11b. Crotalaria medicaginea var. **neglecta** (Wight & Arn.) Baker, in Hook.f., Fl. Br. Ind. 2 :81 (1876); *Crotalaria neglecta* Wight & Arn., Prod. Fl. Pen. Ind. Or. 1: 192 (1834). **Type**: India, *Wallich* 5434 (holo: K; photo: BRI).

Crotalaria medicaginea var. *australiensis* Domin, Biblioth. Bot. 89 (2): 180



Map 6. Distribution of ***Crotalaria medicaginea*** var. ***neglecta.***

(1925). **Type**: Brisbane River, *Dietrich* 915 (lecto, here designated: PR [PR 527137]; isolecto: NSW; photo: BRI).

Crotalaria medicaginea var. *angustata* Domin, Biblioth. Bot. 89 (2): 180 (1925). **Type**: Lappa Junction, Feb. 1910, *K.Domin* (lecto, here designated: PR [PR 527148]; photo: BRI).

Illustrations: Hacker (1990: 119); Hardin (ed.) (1994: 2: 521); Dunlop *et al.* (eds) (1995: 63, fig. 19).

Erect herb to 1 m; stem usually single at base. Leaflets obovate to oblanceolate, 5–40 mm long, 1–10 mm wide, L:W ratio 2–15:1, apex obtuse, truncate, or emarginate; stipules 1–5 mm long. Racemes to 35 cm long; bract 1–2.5 mm long; bracteoles 0.5–1.5 mm long; pedicel 1.5–5 mm long. Calyx 2.5–4 mm long. Standard ovate to obovate or suborbicular, acute or rounded, 5–8 mm long, 4–6 mm wide; keel 4–8 mm long. Pod 4–5.5 mm long.

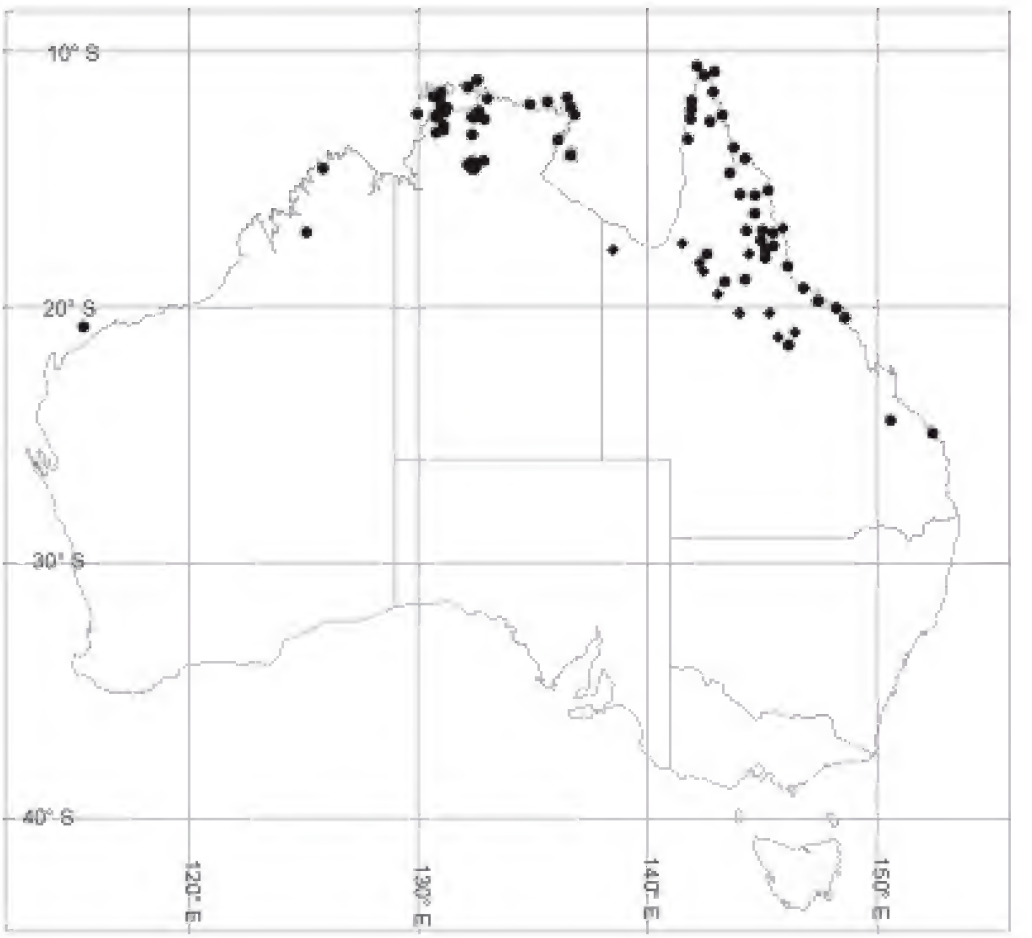
***Selected specimens*: Western Australia.** Upper Carawine Gorge c. 1 km N of road crossing of main channel of Oakover River, Aug 1977, *Barker 2077* (AD, PERTH); 103 miles [165 km] E of Langely's crossing on Fitzroy River, May 1967, *Bennett* 1936 (CANB, PERTH); On the plateau just above the Ord River near Ivanhoe Crossing 10.5 km NNW of Kununurra, Apr 1977, *Eichler* 22178 (CANB, DNA, PERTH); 19 miles [30 km] SSW of Mabel Downs Station, Apr 1955, *Lazarides* 5059 (BRI, PERTH); Kimberley Research Station, Jul 1952, *Perry* 3037 (BRI, CANB, DNA, MEL, PERTH). **Northern Territory.** 13 miles [21 km] S of White Quartz Hill Homestead, Aug 1959, *Chippendale* NT6526 (AD, BRI, CANB, DNA, MEL, PERTH);

McArthur River area, Amelia Springs, Jan 1976, *Craven 3532* (CANB, DNA); Palm Valley, Dec 1968, *Latz* 396 (AD, CANB, DNA); 15 km NNW of Seven Emu, May 1985, *Leach* 637 (CANB, DNA, MEL); 15 miles [24 km] N of Katherine, Feb 1961, *McKee* 8552 (DNA, NSW); 17 miles [27 km] E of Pine Creek, Apr 1962, *Nelson* 277 (AD, DNA, MEL); Edith River Siding 0.5 miles [0.8 km] NW, Jan 1965, *Wilson* 221 (BRI, CANB, NSW). **Queensland.** Burke District: 9 miles [14 km] N of Mount Isa on Barkly Hwy, Jul 1974, *Kratzing* PO 1185 & *Ollerenshaw* (BRI, CANB). Cook District: Newcastle Range, 64 km from Mount Surprise on Georgetown road, Mar 1988, *Forster* PIF 3815 (BRI). North Kennedy District: Pentland, Jan 1982, *Pedley* 4815A (BRI, CANB, MEL). Leichhardt District: Allambie near Springsure, Feb 1960, *Johnson* 1295 (BRI, CANB). Mitchell District: End of Poison Valley road, White Mountains N.P., Apr 1992, *Bean* 4337 (BRI). Port Curtis District: 25.5 km by road SW of Rockhampton from Mount Morgan turnoff, on Bruce Hwy, Feb 1987, *McKenzie* 19 (BRI). Gregory North: Douglas Downs c. 55 miles [88 km] W of Dajarra, Sep 1951, *Everist* 4478 (AD, BRI). Maranoa District. Mount Debateable, Jun 1915, *Bick s.n.* (BRI, NSW). Moreton District: Alice Creek, 7.5 km ESE of Murphy's Creek rail siding, Aug 1990, *Forster* PIF 7108 (BRI, NSW, MEL). **New South Wales.** Taree, Jun 1964, *Noonan s.n.* (NSW). **South Australia.** Mount Woodward, May 1983, *Bates* 3080 (AD); 59 km SE of Bedford Downs Station, Jun 1975, *Symon* 10317 (AD).

***Distribution and habitat*:** Widespread across northern Australia from North-West Cape in W.A., throughout the N.T. and throughout Qld. Also in a few places in northern N.S.W., as far south as Taree. Occurs mostly in open *Eucalyptus* and *Acacia* woodland or grassland, on hillsides, creek banks and gullies, usually in sandy or gravelly soil. Map 7.

***Phenology*:** Flowers and fruits most of the year.

11c. Crotalaria medicaginea var. **linearis** A.E.Holland, **var. nov.**, a varietatibus



Map 7. Distribution of ***Crotalaria medicaginea*** var. ***medicaginea*** ● and ***Crotalaria medicaginea*** var. ***linearis*** ◆.

ceteris foliolis angustioribus 0.5–3 mm latis et L:W ratione 13–35:1 differt. **Typus**: Queensland. BURKE DISTRICT: 70 km NW of Hughenden, 22 Mar 1993, *E.J. Thompson* HUG 350 & *R.J. Henderson* (holo: BRI).

Erect slender herb to 60 cm; stem usually single at base. Leaflets linear, 15–60 mm long, 0.5–3 mm wide, L:W ratio 13–35:1, apex acute; stipules 0.5–2 mm long. Racemes to 24 cm long; bract 1–2 mm long; bracteoles 0.3–0.5 mm long; pedicel 1.5–3 mm long. Calyx 2–3 mm long. Standard ovate, acute, 5–7 mm long, *c.* 5 mm wide; keel 5–7 mm long. Pod 3.5–4.5 mm long.

***Specimens examined*: Queensland**. BURKE DISTRICT: Croydon, Aug 1936, *Blake* 12453 (BRI); About halfway between Croydon and "Esmeralda", Jul 1954, *Blake* 19603 (BRI); Between the Norman and Gilbert Rivers, 1874, *Gulliver* 75 (MEL); 23 km NW of Corinda Homestead, Westmoreland road, May 1974, *Jacobs* 1504 (CANB, NSW); Between Normanton and Kuranda, May 1976, *Scarth-Johnson* 128A (BRI). COOK DISTRICT: Cairns, May 1960, *Lavers s.n.* (BRI). NORTH KENNEDY DISTRICT: Gorge Creek, on old Pentland-Torrens Creek road, Apr 1989, *Cumming* 8966 (BRI). SOUTH KENNEDY DISTRICT: Cape River Crossing, 266 km N of Clermont, Charters Towers road, Jul 1983, *Hacker* BH327 (BRI); Darkies Range, 20 km NNE of Yarrowmere, Jun 1991, *Thompson* 94 & *Henderson* (BRI).

***Distribution and habitat*:** Occurs only in north-western Qld, from the border to Charters Towers. Grows in *Melaleuca* seasonal swamps or open *Eucalyptus* woodland, often on creek banks, in sandy soil. Map 7.

***Phenology*:** Flowers and fruits from March to August.

***Discussion*:** *Crotalaria trifoliastrum* Willd. is a name that has been variously applied in the Australian literature (summarised by Lee 1978). Lee concluded that *C. trifoliastrum* is an "erect, large-flowered subshrub of limited geographical range in India" and that the Australian material is correctly referred to *C. medicaginea*. Examination of photographs of the type specimen of *C. trifoliastrum* and further specimens at Kew (examined by Les Pedley and Rod Seppelt) has confirmed Lee's description of *C. trifoliastrum* as a subshrub with large flowers *c.* 10 mm long. However, Lee did not mention, and perhaps did not see, specimens from north Queensland which also have large flowers, similar to those of *C. trifoliastrum* (*C. aridicola* - see below). Specimens of *C. trifoliastrum* examined at Kew also had consistently long petioles (longer than the leaflets), an observation which appears in Willdenow's original description (1802) as well as descriptions by Wight & Arnott (1834) and Baker (1879). Australian material of both *C. aridicola* and *C. medicaginea* has petioles consistently shorter than the leaflets and the name *C. trifoliastrum* is therefore not applied to Australian material at this time.

Crotalaria medicaginea Lam. has been applied to a widespread taxon occurring in S.E. Asia and India. Baker (1879) described 3 varieties in it: **a.** var. *herniarioides* (Wight & Arn.) Baker (stem prostrate, leaflets small,with L:W ratio *c.* 1:1, peduncles short 1–3 flowered); **b.** var. *neglecta* (Wight & Arn.) Baker (robust, ascending, racemes of 6–9 flowers, leaflets larger); **c.** var. *luxurians* (Benth.) Baker (stem 2–3 feet, petiole ½ inch, terminal leaflet ¾ –1 inch, racemes of 6–12 flowers). Niyomdham (1978) and others placed var. *luxurians* in var. *neglecta* and it is this taxonomy which is followed here. The type material of Domin's var. *australiensis* and var. *angustata*, is not distinguishable from that of var. *neglecta*. Theses names are therefore treated as synonyms of *C. medicaginea* var. *neglecta* here. However, because of the many syntypes cited by Domin, lectotypification for these names is presented here.

***Lectotypification*:** *C. medicaginea* var. *australiensis*. Ten collections cited by Domin in his protologue: **a.** Tambourine Mts, Mar 1910, *K.Domin* (not seen); **b.** Brisbane River, *A. Dietrich* 915, (PR [PR 527137]); ditto, 2784 (not seen); ditto, 1358 (not seen), NSW; **c.** Rockhampton, *Dietrich s.n.* (not seen); **d.** Emu Park, Rockhampton, Mar 1910, *K.Domin* (PR, 2 sheets [PR527138, PR527141]); **e.** Pentland, Feb–Mar 1910, *K.Domin* (PR [PR527140]); **f.** Hughenden, Feb–Mar 1910, *K.Domin* (not seen); **g.** Barcaldine, Feb–Mar 1910, *K.Domin* (PR [PR 527145]); **h.** Flinders River bei Hughenden, Feb–Mar 1910, *K.Domin* (PR [PR527139]). Specimen **b.** is here chosen as lectotype. It best represents the coastal form of *C. medicaginea* var. *neglecta*, which has slightly broader leaflets than do inland forms.

C. medicaginea var. *angustata*. Two syntypes were cited by Domin in his protologue: **a.** Chillagoe district, Feb 1910, *K.Domin* (PR, 2 sheets [PR527149, PR527147]) and **b.** Lappa Junction, Feb 1910, *K.Domin* (PR [PR 527148]). Specimen **b.** is here chosen as lectotype. It represents the northern form of *C. medicaginea* var. *neglecta,* which has smaller leaflets.

12. Crotalaria aridicola Domin, Biblioth. Bot. 89 (2): 180 (1925). **Type:** Queensland. "in colle Metal Mountains apud opp. Chillagoe", Feb 1910, *K.Domin* (lecto, here designated: PR [PR527150]; photo: BRI) (see discussion below).

Erect perennial herb or subshrub to 1 m; stem pubescent, hairs spreading or appressed. Leaves trifoliolate; leaflets obovate to oblanceolate, 7–50 mm long, 1–15 mm wide, apex acute, obtuse or emarginate; upper surface glabrous or sparsely pubescent; lower surface sparsely to densely pubescent; petiole 3–15 mm long, shorter than leaflets; stipules linear, 1.5–6 mm long. Racemes to 30 cm long; flowers 3–50; bract linear-lanceolate, 1.5–5 mm long; bracteoles 1–2 mm long, inserted on the pedicel; pedicel 2–5.5 mm long. Calyx 3.5–7 mm long, pubescent; lobes narrowly triangular, longer than tube. Corolla longer than the calyx, yellow, veins reddish; standard ovate or suborbicular, acute or obtuse, 8–14 mm long and wide; wings oblong, shorter than keel; keel 7–14 mm long, beak twisted. Pod sessile, rhomboid, 5–7 mm long and wide, densely pubescent, beak 1–3 mm long; seeds 2. Seed 1.5–2.8 mm long, oblique cordiform, dark brown.

Three subspecies are recognised here.

Key to subspecies of *Crotalaria aridicola*

1. Leaves crowded on stem; leaflets 1–5 mm wide, L:W ratio 5–32:1 **12c.** subsp. **densifolia**
 Leaves not crowded; leaflets 3–8 mm wide; L:W ratio 2–5:1 2

2. Indumentum on stems, pods and lower surface of leaflets spreading, hairs 0.5–1 mm long **12a.** subsp. **aridicola**
 Indumentum on stems, pods and lower surface of leaves appressed, hairs 0.1–0.5 mm long **12b.** subsp. **glabrata**

12a. Crotalaria aridicola Domin subsp. aridicola

Stem densely pubescent; hairs spreading, 0.5–1 mm long. Leaflets obovate to oblanceolate, 12–33 mm long, 3–15 mm wide, L/W ratio 2–5, obtuse or emarginate; upper surface sparsely pubescent; lower surface densely pubescent, veins obscure. Calyx 5–7 mm long, densely pubescent; lobes nearly twice the length of the tube. Standard broadly ovate, acute, 9–10 mm long, 7–8 mm wide, wings 8–9 mm long; keel 9–12 mm long. Pod densely pubescent; beak 2–3 mm long. Fig. 4A–C.

Selected specimens: **Queensland.** Cook District: Chillagoe, Apr 1938, *Blake* 13635 (BRI); 10 km SE of Mungana on Burke Development road, Feb 1980, *Clarkson* 2830 (BRI); Copperfield River, Kidston Goldmine Water Supply dam, Gilbert Range, Feb 1994, *Forster* PIF 14779 (BRI); 10 km from Almaden on road to Mount Surprise, Jan 1992, *Forster* PIF 9588 (BRI); 90 km from Georgetown, Mount Surprise road, Jul 1983, *Hacker* BH373 (BRI); 8 km from Lynd, Einasleigh-Forsyth road, Jul 1983, *Hacker* BH353 (BRI); Mutchilba, Jan 1962, *Pedley* 4833 (BRI); Near Chillagoe, Jan 1982, *Pedley* 4852 (BRI); Burlington Station, Feb 1950, *Ryley s.n.* (BRI); 10 km NE of Ravenswood, Leichhardt Range, Sep 1991, *Thompson* 501 (BRI); Burke District: Townley Homestead, river flat of Robertson River, Nov 1981, *Mitchell s.n.* (BRI); Near Burketown, May 1976, *Scarth-Johnson* 28A (BRI); North Kennedy District: Maidavale, E of Mingela, Apr 1991, *Bean* 2953 (BRI); Cardington, c. 40 miles [64 km] S of Townsville, May 1954, *Everist* 5519 (BRI); Harvey's Range road, 19 km SW Keelbottom Creek crossing, Apr 1980, *Williams* 80003 (BRI).

Distribution and habitat: Occurs in north Queensland from Burketown to Mount Carbine and as far south as Ravenswood. Grows on hill slopes in open *Eucalyptus* woodland on sandy or loamy soils usually derived from granite or limestone, often in disturbed areas. Map 8.

Phenology: Flowers and fruits most of the year.

12b. Crotalaria aridicola subsp. **glabrata** A.E.Holland, **subsp. nov**. a subsp. *aridicola* pilis brevioribus appressis 0.1–0.5 mm longis differt et a subsp.

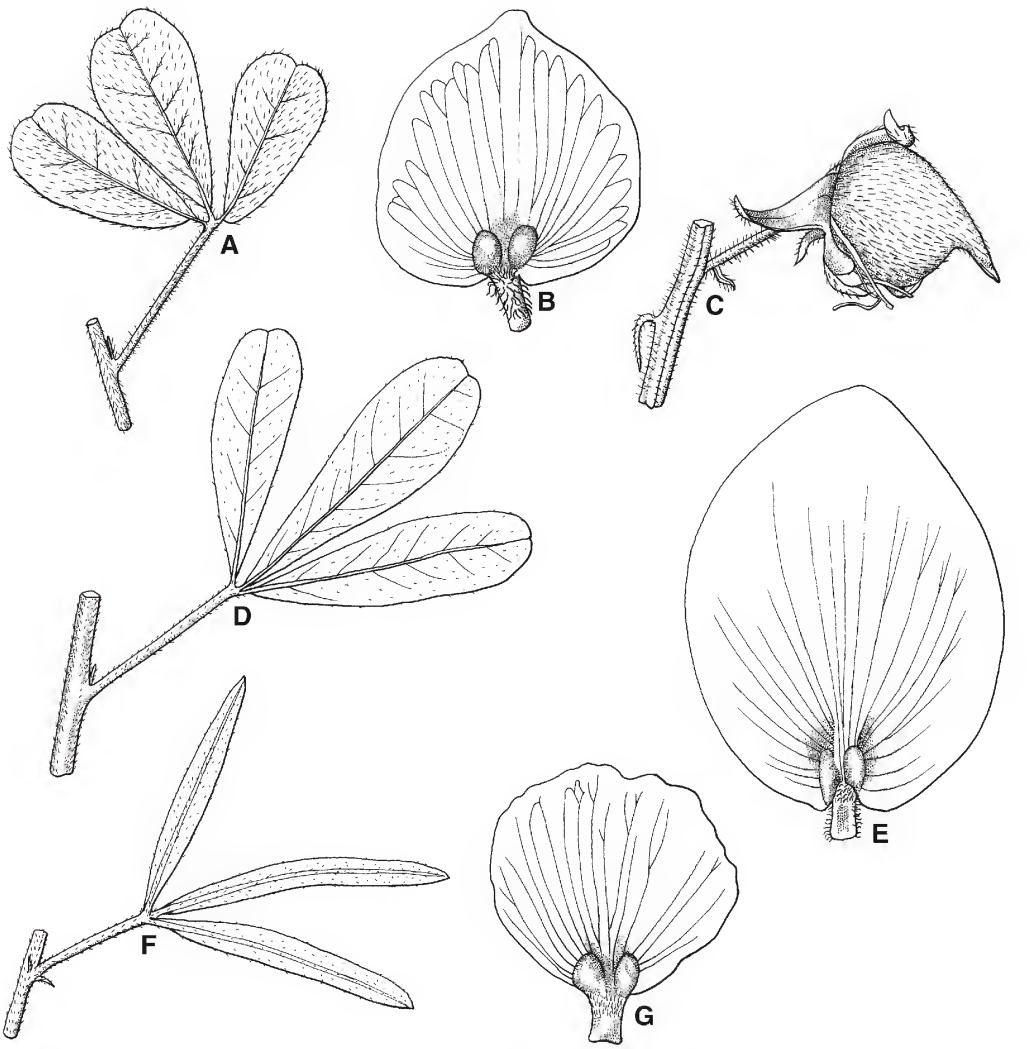
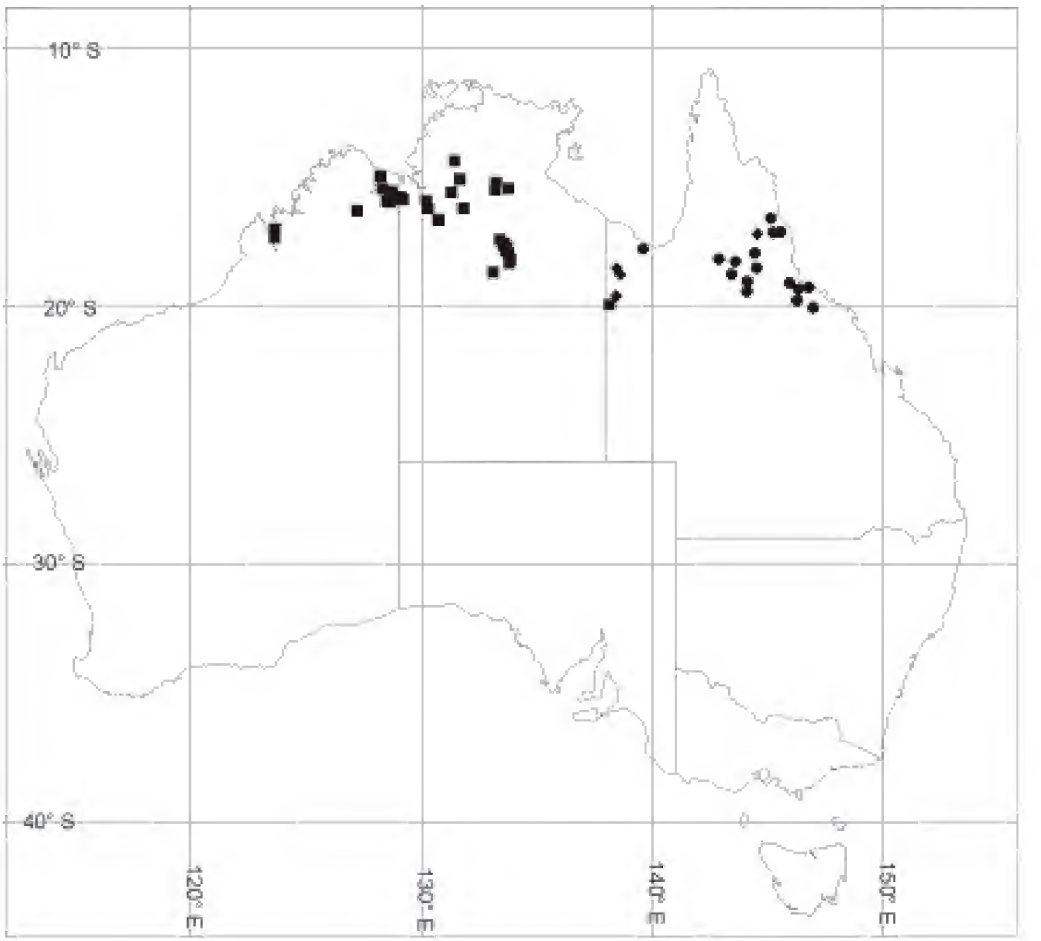


Fig. 4. A–C: ***C. aridicola*** subsp. ***aridicola***. A. leaf × 2. B. standard petal × 4. C. pod × 4. D,E: ***Crotalaria aridicola*** subsp. ***glabrata.*** D. leaf × 2. E. standard petal × 4. F, G: ***Crotalaria aridicola*** subsp. ***densifolia.*** F. leaf × 2. G. standard petal × 4. A–C: *Clarkson* 7940 (BRI). D,E: *Clarkson* 3034 (BRI). F,G: *Maconochie* 577 (BRI).

densifolia foliolis latioribus (3–9 mm latis et L:W ratione 2–5:1) differt. **Typus**: Queensland. Burke District: Lawn Hill National Park, Colless Creek, Apr 1997, *P.I.Forster* PIF 20890 & *A.E.Holland* (holo: BRI; iso: DNA, MEL).

Stem moderately to densely pubescent or nearly glabrous; hairs appressed, to 0.5 mm long. Leaflets obovate, 7–28 mm long, 3–9 mm wide, L:W ratio 2–5:1, apex obtuse or emarginate; upper surface glabrous; lower surface appressed pubescent, veins visible. Calyx 4–6 mm long, appressed pubescent; lobes slightly longer than the tube. Standard ovate to suborbicular, acute or obtuse, 9–14 mm long, 7–14 mm wide; wings 8–13 mm long; keel 8–14 mm long. Pod appressed pubescent; beak 2–3 mm long. Fig. 4D–E.

Selected specimens: **Queensland.** Burke District: Lost City, 2.7 km S of Ridgepole Waterhole, 27 km E of Musselbrook Mining Camp, 17.5 km N of Camooweal, *Johnson* MRS268 & *Thomas* (BRI, MEL); E of Jump-up 33.6 km E of Musselbrook Mining Camp, 175 km N of Camooweal-Lawn Hill N.P., May 1995, *Johnson* MRS1000 & *Thomas* (BRI, DNA); Gulf of Carpentaria, undated,



Map 8. Distribution of ***Crotalaria aridicola*** subsp. ***aridicola*** ●, ***Crotalaria aridicola*** subsp. ***glabrata*** ◆ and ***Crotalaria aridicola*** subsp. ***densifolia*** ■.

Landsborough [MEL2038697] (MEL); Adels's Grove, via Camooweal, undated, *de Lestang* 273 (BRI); Cook District: Chillagoe, near "Dorothy" Mine, May 1983, *Godwin* C2444 (BRI); Chillagoe Station, Mungana, May 1983, *Lewis s.n.* (BRI). North Kennedy District: Townsville, undated, *Betche* 1901 (NSW); Magnetic Island, Horseshoe Bay, Mar 1935, *Blake* 8274 (BRI, CANB); Palleranda Town Common, Jan 1962, *Copeman* 30 (BRI); 2 km SSE of Wunjunga, Mar 1989, *Cumming* 8722 (BRI); Heatley's Parade, Jan 1964, *Jackes* 3 (AD, BRI); Magnetic Island, undated, Cleveland Bay, *Gulliver* 1886 (MEL); Townsville Town Common, Jan 1968, *Henderson* H 330 (BRI); Saunders Beach, 18 km NW of Townsville, Apr 1975, *McDonald* 1442 & *Batianoff* (BRI).

Distribution and habitat: Occurs across northern Queensland, from Mussellbrook (north of Camooweal), to Cape Pallaranda near Townsville. Grows in open *Corymbia, Eucalyptus* and *Terminalia* woodland on shallow stony or sandy soil, often in limestone areas. Map 8.

***Phenology*:** Flowers and fruits from December to May.

12c. Crotalaria aridicola susbp. **densifolia** A.E.Holland, **subsp. nov**. a subspeciebus ceteris foliolis angustioribus (1–5 mm latis et L:W ratione 5–32:1) differt. **Typus**: Northern Territory. 21 miles [34 km] S Elliott, Stuart Hwy, Feb 1969, *J. Must* 361 (holo: CANB; iso: BRI, DNA).

Stem often woody, sparsely pubescent; hairs appressed, to 0.5 mm long. Leaves crowded on stem; leaflet lamina linear to narrowly oblong, 10–50 mm long, 1–5 mm wide, L:W

ratio 5–32:1, apex obtuse or acute; upper surface glabrous or sparsely pubescent; lower surface appressed pubescent, veins visible. Calyx 3.5–6 mm long, appressed pubescent; lobes slightly longer than tube. Standard broadly ovate to suborbicular, rounded, 8–12 mm long and wide; wings 7.5–9 mm long; keel 7–11 mm long. Pod appressed pubescent; beak 1–2 mm long. Fig. 4F–G.

Selected specimens: **Western Australia**. 14.8 km S of Great Northern Hwy, 62 km SSW of Derby, Jun 1976, *Beauglehole* 53026 (PERTH); E boundary track on Mirima N.P., Jan 1994, *Graham* 15 (PERTH); Headwaters of Packsaddle Creek, northern Carr Boyd Range, Mar 1978, *Hartley* 14333 (CANB, PERTH); c. 80 km E of Broome on Broome-Derby road, May 1967, *Jackson* 970 (CANB); Road to Kununurra from CSIRO Research Station, Jan 1968, *Leutert* 50 (CANB, PERTH); Kununurra-Carlton Station road, Apr 1977, *Pullen* 10.900 (CANB, PERTH); Kununurra, Jun 1975, *Symon* 10324 (AD, PERTH). **Northern Territory**. 10 miles [16 km] N Maryfield Homestead, Mar 1969, *Byrnes* 1409 (BRI, DNA); Gregory N.P., c. 28 km SW of Bullita Outstation on direct line of East Baines River, Apr 1996, *Coles* 87 (MEL); 27.7 miles [44.3 km] N Larrimah, May 1960, *Chippendale* NT6976 (DNA, CANB, MEL); 4.8 km N of Newcastle Waters, Jul 1974, *Carr* 2677 (DNA, MEL); 32 km from Renner Springs on Elliot road, Jun 1973, *Gittins* 2554 (BRI, DNA, NSW); 1.5 km W of No. 7 Bore, Newcastle Waters Station, *Henshall* 2594 (CANB, DNA); Elliot, Stuart Hwy, 25 Aug 1993, *Lally* 107 (CANB, DNA); c. 83 km NE of Green Swamp Well No.4, Aug 1986, *Leach* 874 (AD, BRI, CANB); Keep River N.P., Flying Fox Creek, Sep 1992, *Munns* 46 (DNA); 21 km SW Humbert River, Wickham Gorge, Jul 1977, *Parker* 1021 (DNA, CANB); 15 miles [24 km] N of Helen Springs, Sep 1947, *Perry* 127 (CANB); Claravale, Mar 194, *Robinson* D384 (DNA). **Queensland**. Burke District: Camooweal, Aug 1968, *Pocock s.n.* (AD).

Distribution and habitat. Across northern Australia from Broome in W.A., across the N.T. and as far east as Camooweal near the Qld-N.T. border. Occurs in low open woodland or herbland associated with *Acacia, Eucalyptus* and *Triodia*, in red sandy soil or clay loam on sandy plains or rocky creek beds. Map 8.

***Phenology*:** Flowers and fruits all year.

***Discussion*:** *Crotalaria aridicola* subsp. *aridicola* is very densely hairy with spreading hairs. The two new subspecies, *Crotalaria aridicola* subsp. *glabrata* and *C. aridicola* subsp. *densifolia*, are distinguished by their short appressed indumentum. Both have leaflets with a glabrous or nearly glabrous upper surface. *Crotalaria aridicola* subsp. *densifolia* is distinguished by the crowded leaves and narrow leaflets. The three subspecies have somewhat overlapping distributions (see map 8).

Crotalaria aridicola, as presently understood, is endemic in Australia but is closely related to *C. trifoliastrum*, differing from that species by its petioles which are shorter than the leaflets (see discussion under *C. medicaginea*). *Crotalaria aridicola* subsp. *densifolia* superficially resembles *C. willdenowiana* DC. but this species has smaller flowers (6–8 mm long) and pods (c. 4 mm long).

***Lectotypification*:** Three collections were cited by Domin in his protologue of *Crotalaria aridicola*, all from the Chillagoe area; **a.** "in den Savannenwaldern zwishen Chillagoe und den Metal Mtns", Feb 1910, *K.Domin* (PR, 2 sheets [PR527150 and PR527151]); **b.** auf Karstkalk des Smelling Bluff", Feb 1910, *K.Domin* (PR [PR527152]); **c.** "Calficer etc.", Feb 1910, *K.Domin* (PR [PR527153]). The specimen from collection **a.**, sheet PR527150, is the largest and most complete specimen of the taxon and is here chosen as the lectotype of Domin's name.

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I would like to thank Will Smith for providing the illustrations and Peter Bostock who assisted with translating Latin and setting up label databases and providing the maps. My thanks go also to Les Pedley, Rod Seppelt and Bob Chinnock who located and photographed type specimens, and made observations on Indian and Asian material at K, BM and P for me. I would also like to thank Paul Forster and Les Pedley for remarks upon the manuscript and Tracey Spokes who assisted in dealing with the thousands of *C. cunninghamii* specimens in particular. Andrew Mitchell, Keith McDonald and Paul Forster also assisted with field collections in different parts of Australia. I am grateful to the directors of AD, CANB, DNA, HO, K, MEL, NSW, P, PERTH and PR for the loan of specimens, and to the many others who contributed material and comments during the study. This study was partly funded by a grant provided by the Australian Biological Resources Study.

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Oldenlandia intonsa (Rubiaceae), a new species from the Northern Territory

David A. Halford

Summary

Halford, D. (2002). *Oldenlandia intonsa* (Rubiaceae), a new species from the Northern Territory. *Austrobaileya* 6(2): 325–327 . *Oldenlandia intonsa*, a new species closely related to *O. thysanota*, is described and illustrated. Notes on habitat and distribution are provided.

Keyword: *Oldenlandia intonsa*, Rubiaceae, Northern Territory.

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Introduction

The examination of some unidentified *Oldenlandia* collections while on a visit to the National Herbarium of Victoria (MEL) in March 2000, led to the identification of a specimen from Kakadu National Park, Northern Territory that did not match any of the previously described species of *Oldenlandia* in Australia (Halford 1992). The specimen was superficially similar to *O. thysanota* but differed in a number of key characters that are detailed below.

Taxonomy

Oldenlandia intonsa Halford, **sp. nov.** affinis maxime arcte *O. thysanota* autem indumento hispido (± glabro in *O. thysanota*), corollae tubo lobisque brevioribus, tubo 2.5–2.7 mm longo (5–7.5 mm in *O. thysanota*) et lobis 2.8–3 mm longis (3.5–5.5 mm in *O. thysanota*), sepalis anguste triangularis (vice linearibus) corollae marginibus loborum glabris non fimbriatus differt. **Typus:** Northern Territory. Kakadu National Park, Kakadu Highway, 1.2 km E of entrance to Mary River Ranger Station, 28 April 1990, *A.V. Slee* 2950 & *L.A. Craven* (holo: MEL)

Diffuse annual, dichotomously branched from base. Branchlets erect or ascending, slender, terete, hispidulous. Hairs simple, spreading unicellular, 0.1–0.5 mm long. Leaves opposite, sessile, linear-lanceolate, 10–15 mm long, 1.0–1.5 mm wide, acute at apex, erect hairs on upper surface and along midrib below, with margin somewhat recurved especially towards base; midvein prominent below. Stipules fused and adnate to the leaf base; stipule-sheath 0.5–1.3 mm long, sparsely hairy, produced into single lobe, with entire margins. Inflorescences 1 or 2 times dichasially branched then monochasial cymes. Bracts small, leaf-like at nodes, up to 7 mm long. Flowers mostly in pairs at nodes of cymes, on unequal pedicels. Pedicels 0.4–4.5 mm long. Hypanthium globose, c. 0.9 mm diameter, hispidulous. Calyx lobes 4, narrowly triangular, 1.7–2.1 mm long, 0.6–0.8 mm wide, shortly connate at base; sinus between lobes acute, colleters absent. Corolla white, with faint purple spots at the base of lobes, hypocrateriform; tube 2.5–2.7 mm long, slightly wider distally, glabrous inside, glabrous or with a few hairs outside; throat glabrous, callose; lobes 4, ovate-elliptic, 2.8–3.0 mm long, c. 1.8 mm wide, with glabrous margin, adaxial surface with a sparse covering of simple hairs . Stamens exserted; filaments c. 2 mm long, erect, reflexed with age; anthers linear, c. 0.7 mm long. Style exserted from tube when mature, c. 4.0 mm long; stigma bifid; lobes filiform, c. 0.9 mm long, twisted, glandular hairy; placenta fleshy, peltately attached to septum; ovules c. 15/locule. Capsule crustaceous, globose, c. 1.8 mm diameter, hispid, persistent calyx lobes 1.7–3.5 mm long;

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beak slightly raised, rounded, splitting loculicidally. Seeds squat-angular, c. 0.5 mm across, truncate at apex; testa faintly reticulate black. Fig 1.

***Specimens examined*:** only known from type collection.

***Distribution and habitat*:** *O. intonsa* is known only from Kakadu National Park. Recorded as occurring in pale brown sandy soil in *Eucalyptus tetrodonta* forest with tall acacias.

***Phenology*:** Flowers and fruits have been recorded in April.

***Affinities*:** *Oldenlandia intonsa* seems most closely related to *O. thysanota* but differs from that by the hispid indumentum, its shorter corolla tube and corolla lobes, in the shape of its calyx lobes, and its glabrous corolla lobe margins. These major differences are summarised in Table 1.

Table 1. Morphological comparison of *Oldenlandia intonsa* and *O. thysanota*.

Character	*O. intonsa*	*O. thysanota*
indumentum	hispidulous	± glabrous
corolla tube length (mm)	2.5–2.7	5–7.5
corolla lobe length (mm)	2.8–3.0	3.5–5.5
corolla lobe margin	glabrous	fimbriate
calyx lobes (shape)	narrowly triangular	linear

***Etymology*:** The specific epithet is derived from the Latin *intonsus* (unshaven) and refers to the indumentum that is conspicuous on the branchlets and fruits.

Acknowledgements

I am grateful to the Director of MEL for access to the herbarium and loan of the specimen. I wish to thank Will Smith (BRI) for the illustration, Les Pedley for the Latin diagnosis, and Gordon Guymer, Director, Queensland Herbarium (BRI) allowing access to the facilities at BRI.

Reference

HALFORD, D. (1992). Review of the genus *Oldenlandia* L. (Rubiaceae) and related genera in Australia. *Austrobaileya* 3(4): 683–721.



Fig. 1. ***Oldenlandia intonsa*.** A. habit. × 0.5. B. flower. × 8. C. fruit. × 8. A–C from *Slee & Craven* 2950 (MEL). Del. W. Smith.

Phyllanthera takeuchiana (Apocynaceae: Periplocoideae), a new species from Papua New Guinea

Paul I. Forster

Summary

Forster, Paul I. (2001). *Phyllanthera takeuchiana* (Apocynaceae, Periplocoideae), a new species from Papua New Guinea. *Austrobaileya* 6(2): 329–331. The new species *Phyllanthera takeuchiana* P.I.Forst. is described and illustrated. It is known from a single collection from Lake Lamu in the Gulf Province of Papua New Guinea. Differences between *P. takeuchiana* and *P. multinervosa* (P.I.Forst.) Venter are outlined.

Keywords: *Phyllanthera takeuchiana;* Papua New Guinea; *Phyllanthera multinervosa;* Apocynaceae; Periplocoideae; Asclepiadaceae

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Introduction

A conspectus of the Malesian taxa of *Cryptolepis* R.Br. has been provided by Forster (1993), wherein some seven species were enumerated with five occurring in New Guinea. These species were classified into two subgenera, *C.* subgenus *Cryptolepis* and *C.* subgenus *Phyllanthera* (Blume) P.I.Forst. Four of the New Guinea species and the single Australian species (*C. grayi* P.I.Forst.), have now been formally transferred into *Phyllanthera* Blume by Venter in Venter & Verhoeven (2001). Both *Phyllanthera and Cryptolepis* are considered worthy of generic distinction by these authors, a morphologically based decision with which I concur. A recent collection (1996) by Wayne Takeuchi of a *Phyllanthera* from Lake Lamu in the Gulf Province represents a further species in this genus and is formally described herein.

Phyllanthera takeuchiana P.I.Forst., **sp. nov.** affinis *Phyllantherae multinervosae* P.I.Forst., a qua lamina folii venatione tertiaria obscura (adversum obscure visibilem), corolla campanulato-rotata, lobis elliptico-ovatis 9–11 mm longis 5–6 mm latis et intus papillosis, papillis brevis (< 0.3 mm longis) toti paginae praeter vittam 1 mm latum circum aciem insidentibus (adversum corollam profunde rotatam, lobis lanceolato-falcatis 13–14 mm longis 2.5–3 mm latis, intus dense papillosis, papillas longiores (ad 1 mm longis) in vitta angusta parte media gerentibus), gynostegio columnae insidenti (adversum sessile) et appendicibus antherae late flabellatis (non oblongo-acutis) differt. **Typus:** Papua New Guinea. Gulf Province: Lake Lamu, east branch of the Avi Avi River, 7°44'S, 146°29'E, 26 Oct. 1996, *W.Takeuchi* 11451 & *J.Kulang* (holo: BRI. [1 sheet + spirit]; iso: LAE n.v.).

Liane, latex white. Stems cylindrical, up to several metres long, glabrous when young, lenticellate when old; internodes up to 50 mm long and 2 mm diameter, light-brown. Stipules linear-lanceolate, several at internodes, 0.8–1 mm long, c. 0.5 mm wide, dark brown. Leaves petiolate; petiole 4–6 mm long, c. 1 mm diameter, grooved along top; lamina elliptic-oblong to lanceolate-ovate, coriaceous, 50–85 mm long, 15–35 mm wide, discolorous, upper surface dark dull-green, venation obscure, lower surface pale green to glaucescent, venation prominent; secondary lateral veins 34–36 per side of midrib at c. 90 degrees, tertiary venation obscure; tip long-acuminate; base rounded. Cymes 15–40 mm long, with 1 or 2 fascicles of flowers; peduncle 5–8 mm long, c. 8 mm diameter, glabrous; bracts triangular-lanceolate, 0.7–0.8 mm long, 0.6–0.7 mm wide, glabrous. Flowers 6–10 mm

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long, 12–20 mm diameter; pedicels 5–7 mm long, c. 1 mm diameter, glabrous; sepals triangular, c. 1.5 mm long and 1.5 mm wide, glabrous; corolla campanulate-rotate, tube much reduced, externally off-white with a faint red tinge, internally light red, turning cream towards the centre; lobes elliptic-ovate, 9–11 mm long, 5–6 mm wide, externally glabrous, internally papillose with very short papillae (< 0.3 mm long) over the entire surface but not for c. 1 mm around the left-hand edge when viewed from centre of flower. Gynostegium c. 3 mm long and 4 mm diameter, on a short column c. 2 mm long; filaments c. 1.5 mm long, flattened, c. 0.3 mm wide at base and 0.5 mm wide at apex; anthers c. 1.5 mm long and 1.5 mm wide, appendages broadly flabellate; style-head c. 1 mm diameter. Fruit and seed not seen. Fig. 1.

Notes: *Phyllanthera takeuchiana* appears to be most closely allied to *P. multinervosa* (P.I.Forst.) Venter that is only known from Lake Kutubu in the Southern Highlands Province of Papua New Guinea (Forster 1993).

P. takeuchiana differs from *P. multinervosa* in the obscure tertiary venation in the leaf lamina (versus visible), the campanulate-rotate corolla with elliptic-ovate lobes that are 9–11 mm long and 5–6 mm wide and internally papillose with short (< 0.3 mm long) papillae over the entire surface apart from a 1 mm band around the left-hand edge (versus a deeply rotate corolla with lanceolate-falcate lobes that are 13–14 mm long and 2.5–3 mm wide and internally densely papillose with long (to 1 mm) papillae in a narrow band in the middle), the gynostegium on a column (versus sessile) and the anther appendages being broadly flabellate (versus oblong-acute). Using the key of Forster (1993), *P. takeuchiana* will key to *P. multinervosa*, but can be distinguished by the characters outlined above.

Distribution and habitat: *Phyllanthera takeuchiana* is only known from the type locality where it was collected from rainforest surrounding a lake at c. 100 m altitude.

Etymology: The specific epithet honours Dr. Wayne Takeuchi collector of the type specimen and who has made a number of interesting collections of Asclepiadoideae in New Guinea.

Acknowledgements

Thanks to Wayne Takeuchi for the plant material, Will Smith for the illustrations and Peter Bostock for translation of the diagnosis into Latin and comments on the manuscript.

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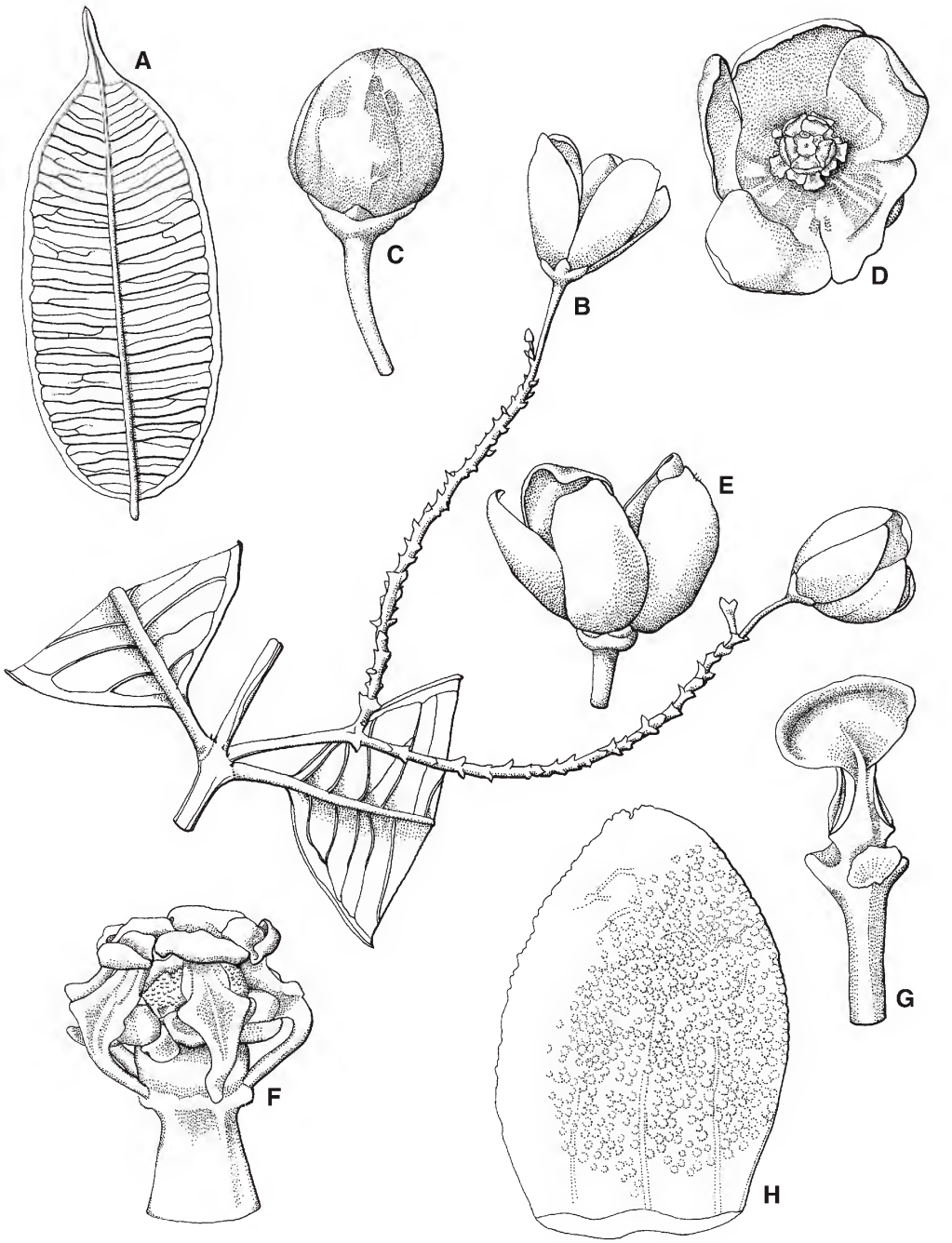


Fig. 1. ***Phyllanthera takeuchiana***. A. undersurface of leaf showing venation. × 1. B. flowering inflorescence. × 2. C. bud. × 2. D. face view of flower. × 3. E. side view of flower. × 3. F. staminal column (gynostegium). × 9. G. rearview of anther showing flabellate head. × 12. H. corolla lobe showing distribution of papillae. × 6. All from *Takeuchi* 11451 (BRI). Del. W. Smith.

A new species of *Eupomatia* R.Br. (Eupomatiaceae) from Queensland

L.W. Jessup

Summary

Jessup, L.W. (2002). A new species of *Eupomatia* R.Br. (Eupomatiaceae) from Queensland. *Austrobaileya* 6(2): 333–335. *Eupomatia barbata* Jessup, a new species from the Wet Tropics of north-east Queensland is described and illustrated. A key to identify the three species now recognised in *Eupomatia* is provided.

Key words: *Eupomatia barbata*, Eupomatiaceae, Queensland flora, taxonomy.

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Introduction

The genus *Eupomatia* was formally established by Robert Brown (1814) when he described *E. laurina* R.Br. from Port Jackson, New South Wales. A second species *E. bennettii* was described by F. Mueller (1858) from Clarence River, New South Wales. The genus was originally placed in Annonaceae and is still regarded as closely related to this family as well as to Himantandraceae. The monogeneric family Eupomatiaceae was described (as Eupomatieae) by Endlicher (1841). The flowers of *Eupomatia* lack a perianth, the flower being protected in bud by a bract that forms a floral envelope which splits circumferentially in *E. laurina* and irregularly in *E. bennettii* and in the new species described here. The process of anthesis in *E. laurina* and *E. bennettii* was described in detail by Endress (1984).

Taxonomy

Eupomatia barbata Jessup **sp. nov.** ab *E. laurina* R. Br. habitu frutice pumilo et inflorescentia flore singulari terminali et ab *E. bennettii* F.Muell. et *E. laurina* staminibus et staminodiis cum pilis dendriticis dense intricatis et staminodiis interioribus cum pilis caespitosis glandulosis nonnisi in paginis adaxialibus differt. **Typus**: Queensland: Cook District. Noah's Head area, Cape Tribulation, Oct 1971, *L.J. Webb & J.G. Tracey* 10269; (holo: BRI).

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Shrub to 1m, often flowering at less than 30cm high; roots with tubers. Leaves oblanceolate or narrowly obovate, acuminate; petiole 2.5–6 mm long, decurrent as with stem ridges. lamina 6–22 cm long, 1.5–5.5 cm wide, glabrous adaxially above, pilose adaxially below with isolated simple and dendritic hairs, glabrescent; base attenuate; secondary veins 10–14 pairs. Flower usually solitary, white, terminal; peduncle c. 0.5 cm long above the uppermost foliaceous bract. Floral envelope cap conical with an attenuate tip, bluish-green, splitting irregularly at anthesis. Stamens ovate, oblong or obspathulate, 3.5–6.5 mm long, 1.2–2.5 mm wide near their base; anthers oblong, 1.8–2.5 mm long. Anther thecae and upper margins of stamens and outer staminodes bearded with densely entangled hyaline, dendritic hairs, 0.5–1 mm long. Outer staminodes membranous, ovate, 6–7 mm long, 3.5–4 mm wide. Inner staminodes fleshy, oblong, 5–7 mm long, 2.5–4 mm wide; glandular hair tufts on short pedestals on the adaxial surface. Aggregate fruit obconical, 1.5–2 cm diam. Fig. 1.

Specimens examined: **Queensland**. Cook District: Speewah, upper Clohesy River, Mar 1948, *Brass* 18218 (BRI); Junction Creek, Russell River, Apr 1948, *Brass* 18270 (BRI); Mt Hedley, 3km east-northeast of Rossville, Timber Reserve 165, Apr 1999, *Forster* PIF24273 & *Booth* (BRI); State Forest 310, Goldsborough, 13.5km along Goldsborough Road, Jul 2000, *Forster* PIF25896, *Booth* and *Jensen* (BRI); Bingil Bay, Clump Point National Park, Jul 2000, *Forster* PIF25947 & *Booth* (BRI); 'Cauliflorous fig' site W of lower Kraft Creek, Jul 1995, *Hunter* JH5037 (BRI); Crawfords Lookout to Tchupalla Falls track, Feb 1982, *Jessup* 475 & *Tracey* (BRI); c. 1km W of Garradunga and c. 14km N of Innisfail, Nov 1982, *Jessup* 508 (BRI); upper reaches of

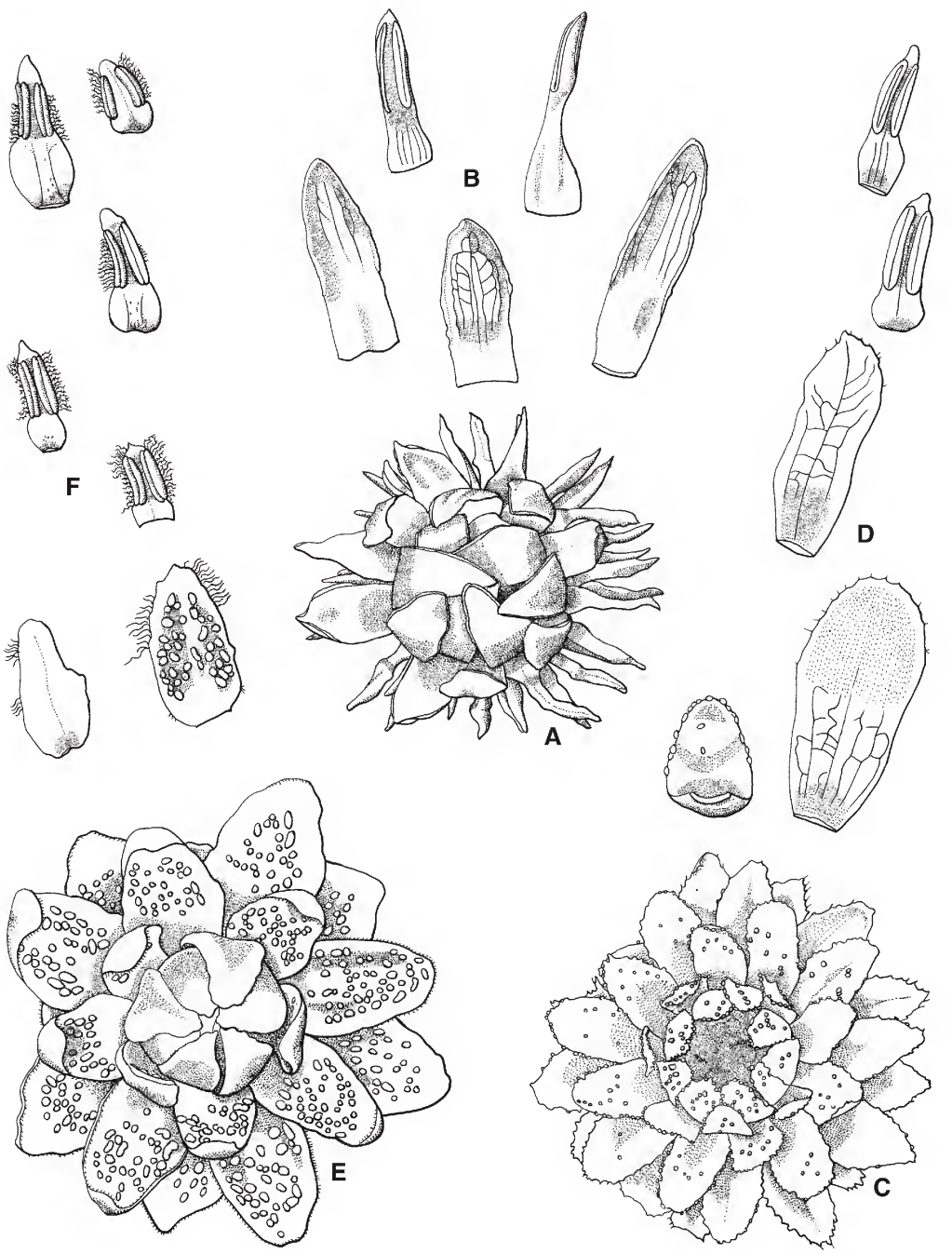


Fig. 1. A & B: ***Eupomatia laurina***. A. flower × 2; B. stamens and staminodes × 3. C & D: ***Eupomatia bennettii***. C. flower × 2; D. stamens and staminodes × 3. E & F: ***Eupomatia barbata***. E. flower × 2; F. stamens and staminodes × 3. A & B: *Jessup* 902 (BRI). C & D: *Bostock* s.n. AQ567859 (BRI). E & F: *Sankowsky* s.n. AQ567858 (BRI). Del. W. Smith.

North Johnstone River in SF 755 on road from Glen Allyn and NE of Millaa Millaa, Nov 1982, *Jessup* 528 (BRI); Nandroya Falls track, Henrietta Creek, Nov 1992, *Jessup* 908 (BRI); Noah Head, 5.6km SSW of Cape Tribulation beach, Nov 1988, *Jessup* GJM641, *Guymer & McDonald* (BRI); South of Junction of E and W Mulgrave Rivers, SF 310, Goldfield LA, Nov 1988, *Jessup* GJM1661, *Guymer & McDonald* (BRI); Stallion Pocket, 8.6km SSE of Little Mulgrave township, Nov 1988, *Jessup* GJM1857, *Guymer & McDonald* (BRI); Jordan LA, 16.5km SE Millaa Millaa, Oct 1988, *Jessup* GJM2006, *Guymer & McDonald* (BRI); Downey Creek, SA 34, 24.6km SE of Millaa Millaa, Oct 1988, *Jessup* GJM2191, *Guymer & McDonald* (BRI); 1.4km SE of Cooroo Peak at the head of Culla Creek, 14km NW of South Johnstone, Oct 1988, *Jessup* GJM2554, *Guymer & McDonald* (BRI); Shiptons Flat, Nov 1992, *Sankowsky* (BRI) (spirit material only); Juara Creek area, c. 16km NE of Atherton, Aug 1948, *Smith* 3785 (BRI); Baileys Creek, north of Daintree River, 1962, *Webb & Tracey* 6483 (BRI); Boonjee, W of Mt Bartle Frere, 1962, *Webb & Tracey* 6563, 6580 (BRI); Gregory Falls, Lower Palmerston via Innisfail, 1962, *Webb & Tracey* 6629 (BRI); Miriwinni near Mt Bartle Frere, 1962, *Webb & Tracey* 6675 (BRI); El Arish-Mission Beach Road, 1962, *Webb & Tracey* 6789 (BRI); Macnamee Creek National Park W of Mena Creek, near Innisfail, Oct 1968, *Webb & Tracey* 11369 (BRI); Mt Sampson, Jun 1973, *Webb & Tracey* 11827 (BRI); Brinsmead Road near Cairns, Dec 1977, Webb & *Tracey* 13736 (BRI); Bellenden Ker, Mar 1922, *White* 1254 (BRI) (ft); between Cairns and Herberton, 1891, *Wild* s.n. (BRI) (fl). NORTH KENNEDY DISTRICT: near Koolmoon Creek, Apr 1956, *White* 1304 (BRI).

***Distribution and Habitat*:** Occurs from the Annan River to the Tully River, Queensland, in mesophyll and notophyll vine forest.

Conservation Status: The species is adequately conserved in the National Parks throughout its range.

Etymology: The specific epithet is from Latin *barba*, a beard, referring to the tangled hairs present on the stamens and outer staminodes.

Acknowledgements

I would like to thank Garry Sankowsky for providing spirit material of the new species, Will Smith for the line drawings and Les Pedley for checking the Latin diagnosis.

Key to species of *Eupomatia*

1. Woody shrub or small tree; stem internodes terete; flowers axillary **E. laurina**
 Herbaceous shrubs with few leaves; stem internodes 2-ridged, decurrent with petiole; flower terminal, usually solitary 2

2. Stamens glabrous or with scattered minute hairs; inner staminodes with glandular hair tufts on margins and both surfaces **E. bennettii**
 Stamens and outer staminodes with densely entangled dendritic hairs; inner staminodes with glandular hair tufts only an adaxial surface **E. barbata**

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Indagator fordii, a new genus and species of the Sterculiaceae from northern Queensland, Australia

David A. Halford

Summary

Halford, D.A. (2002). *Indagator fordii*, a new genus and species of the Sterculiaceae from northern Queensland, Australia. *Austrobaileya* 6 (2): 337–340. The new genus *Indagator* Halford is described with a single species *Indagator fordii* Halford. Notes on its distribution and habitat are provided.

Key words: Sterculiaceae, taxonomy, Australian flora, *Indagator*, *Indagator fordii*

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Introduction

Mr Andrew Ford of CSIRO, Atherton, Queensland brought to my attention fruiting collections from Silver Plains Holding in north east Queensland (*Hyland* RFK25863; *Gray* 06459; *Gray* 06455) that were filed in the Queensland Herbarium (BRI) under the genus *Commersonia* (Sterculiaceae). Examination of these collections and additional flowering material supplied by Mr Ford revealed that the taxon concerned did not belong in the genus *Commersonia* as there are some important differences in floral morphology that preclude its inclusion in that genus. Further investigations found that the collections could not be satisfactorily placed in any of the presently described genera in the Sterculiaceae or Tiliaceae that had been recorded for Australia. Based on Hutchinson's (1967) combined key to the tribes of Tiliaceae and Sterculiaceae, this material belongs in tribe *Helmiopsideae* of the Sterculiaceae. However, the material is not referable to any of the genera he included in the tribe (*Helmiopsiella* J.Arènes, *Helmiopsis* H.Perrier and *Nesogordonia* Baill.) and is described here as both a new genus and species belonging in tribe *Helmiopsideae*.

Indagator fordii Halford, **gen. et sp. nov.** Arbor semidecidua usque 9 m alta sine anteridibus. Ramuli juvenes ± cylindrici dense stellate pubescentes; pili stellati sessiles multiangulati. Folia simplicia, spiraliter alterna, stipulata, petiolata. Stipulae ± lineares, 4–9 mm longae, c. 0.5 mm latae, caducae, dense stellate pubescentes. Lamina folii ovata, 9–19 cm longa, 6–13 cm lata, chartacea, apice acuta vel obtusa vel rotundata, basi obtusa usque leviter cordata, marginibus leniter denticulatis 6–10 dentibus parvis utrinque; domatia carentia; venatio palmata 5–7 venis e basi et utroque venarum primariarum latere 3–5; venae primariae lateralesque glande parva pubescente protrudenti in margine folii terminatae; venae laterales c. 45° e venis primariis divergentes, curvatae pro tota longitudine; venae interlaterales ± scalariformes. Inflorescentiae thrysoides, axillares, ad axillas superas limitatae, bracteatis cymulis ultimis 3–5 floribus. Flores bisexuales pedicellati. Sepala 5, valvata sub anthesi tarde secedentia plerumque proximaliter connata remanentia, 5–7 mm longa; pagina abaxialis verrucata, stellate pubescens; pagina adaxialis laevis, ± glabra praeter pilos crispatos simplices dissitos. Petala 5, anguste obovata, 9–11 mm longa, 3–4.5 mm lata, glabra, incisuris irregularibus distaliter. Stamina 25–30; filamenta teretia glabra, basi breviter connata; antherae dorsifixae bilobatae, thecis ellipsoideis, longitudinaliter dehiscentes. Staminodia 5, ligulata, c. 3.2 mm longa, glabra.

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Ovarium superum, sessile, 5(raro 4) loculare, depresso-globosum, dense stellate pubescens; ovula apicaliter affixa, 1–4 in quoque loculo; styli 5(raro 4), coaliti longitudinaliter, 4.5–5.5 mm longi, ± glabri praeter pilos stellatos dissitos proximaliter; stigma parvum. Fructus capsula tarde dehiscens, dense stellate pubescens, spinis validis 4–10 mm longis tecta, corpore fructus depressogloboso, c. 15 mm longo, c. 22 mm lato. Semen ovoideum, 7–8 mm longum, c. 5 mm in latitudine, in exotesta papyracea persistente inclusum. **Typus:** Queensland. Cook District: Klondike Mine Road, 1 Dec 1995, *B. Gray* 6455 (holo: BRI).

Semi-deciduous tree up to 9 m high, without buttresses, occasionally multistemmed; stems up to 10 cm dbh. Bark fissured, flaky; outer blaze yellow, white or cream with longitudinal stripes and fibrous. Young branchlets ± cylindrical, densely stellate-pubescent, glabrescent; stellate hairs sessile, multiangulate, ferruginous, up to 0.5 mm across. Older branchlets longitudinally rugose, sparsely lenticellate, ± greyish coloured; lenticels ± circular or elliptic, up to 1 mm at their widest point, whitish or pale brown. Leaves simple, spirally alternate, stipulate, petiolate. Stipules ± linear, 4–9 mm long, c. 0.5 mm wide, densely stellate-hairy, caducous. Petioles cylindrical, 3–8 cm long, slightly swollen at base and at the junction with the leaf lamina, densely stellate-hairy when young with hairs similar to those of the young branchlet, glabrescent. Leaf lamina ovate, 9–19 cm long, 6–13 cm wide, chartaceous, acute, obtuse or rounded at apex, obtuse to shallowly cordate at base, with margins weakly denticulate with 6 to 10 small teeth per side; adaxial and abaxial surfaces stellate pubescent when young, becoming glabrous except for persistent stellate hairs along primary and lateral veins; domatia absent; venation slightly raised on adaxial surface, prominent on abaxial surface, palmate with 5–7 veins from base with 3 to 5 lateral veins per side of primary veins; primary and lateral veins ending in a small hairy gland protruding from leaf margin; lateral veins at c. 45 deg. to primary veins, curved throughout their length; interlateral veins ± scalariform. Inflorescences thyrsoid, axillary, confined to the upper leaf axils, bracteate, 15–30 mm long, with ultimate cymules 3–5 flowered; peduncles densely stellate-hairy; bracts narrowly oblong to linear, 1–4 mm long, densely stellate-hairy. Flowers bisexual, pedicellate; pedicels ± terete, 5–7 mm long, densely stellate-hairy. Sepals 5, valvate, tardily separating at anthesis, usually remaining connate proximally, 5–7 mm long; abaxial surface verrucate, stellate-hairy; adaxial surface smooth, ± glabrous except for scattered crispate simple hairs distally. Petals 5, narrowly obovate, 9–11 mm long, 3–4.5 mm wide, glabrous, irregularly notched distally. Stamens 25–30; filaments terete, 3–5 mm long, glabrous, shortly connate at base; anthers c. 0.5 mm long, dorsifixed, bilobate, with thecae ellipsoid, longitudinally dehiscent. Staminodes 5, ligulate, c. 3.2 mm long, glabrous. Ovary superior, sessile, 5(rarely 4)-locular, depressed globose, c. 1.3 mm long, c. 2 mm across, densely stellate-hairy; ovules attached apically, 1–4 in each loculus; styles 5(rarely 4), fused along their length, 4.5–5.5 mm long, ± glabrous except for scattered stellate hairs proximally; stigma small. Fruit a capsule, tardily dehiscent, densely stellate-hairy, densely covered with spines 4–10 mm long; fruit body depressed globose, c. 15 mm long, c. 22 mm wide. Seed ovoid, 7–8 mm long, c. 5 mm across, loosely enclosed in papery, persistent exotesta. Fig. 1.

***Additional specimens*: Queensland.** Cook District: Klondike Mine Road, Silver Plains Holding, May 1995, *Hyland* RFK25863 (BRI); Klondike Mine Road, Dec 1995, *Gray* 06459 (BRI); cult. Atherton, exl Silver Ptains Holding Jan 2002, *Ford* 2606 (BRI).

***Distribution and habitat*:** *Indagator fordii* is known only from the type locality on Silver Plains Holding, c. 15 km SE of Coen, Cape York Peninsula, Queensland, where it is recording as growing in vine thickets.

***Phenology*:** Flowering has been observed in cultivation from January and February (A. Ford, 2002, pers. comm.); mature fruits have been recorded in the native population in December and May.

***Etymology*:** The generic name *Indagator* is Latin for an investigator or explorer and refers to the ship "*Investigator*" which was

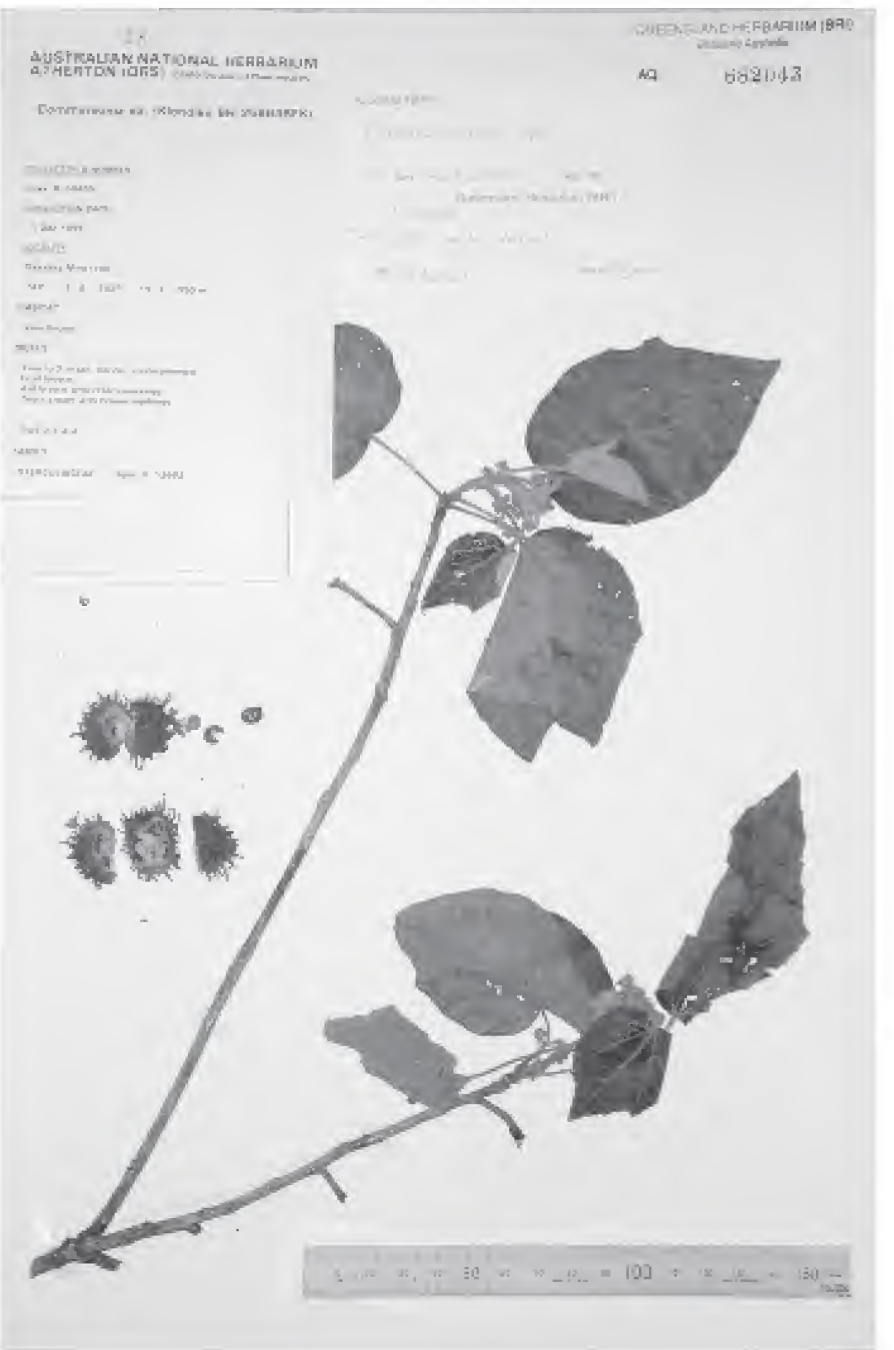


Fig. 1. *Indagator fordii*. Photograph of holotype.

commanded by Matthew Flinders when he carried out a circumnavigation of the Australian continent from 1801 to 1803. The generic name has masculine gender.

The specific epithet honours Andrew Ford of Atherton, Queensland, an avid and talented field botanist whose collections have greatly improved our knowledge of north east Queensland flora.

Acknowledgements

I would thank Andrew Ford for bringing this species to my attention and supplying flowering specimens, Gordon Guymer for making space and facilities available at BRI to me, Les Pedley for providing the Latin name and description for me, and an anonymous referee for commenting on the manuscript.

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Rediscovery of *Glossocardia orthochaeta* (F. Muell.) Veldk. (Asteraceae) from north-east Queensland

A. B. Pollock

Summary

Pollock, A.B. (2002). Rediscovery of *Glossocardia orthochaeta* (F. Muell.) Veldk. (Asteraceae) from north-east Queensland. *Austrobaileya* 6 (2): 341–343. Details of the third record of the rare and poorly known *Glossocardia orthochaeta* (F. Muell.) Veldk. are presented. The habitat of this taxon is described for the first time. A revision of its conservation status to "Vulnerable" is recommended.

Keywords: *Glossocardia orthochaeta*.

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Introduction

The Queensland Herbarium (BRI) has recently completed a detailed survey of the vegetation of the far-eastern Einasleigh Uplands bioregion, as part of the mapping of the vegetation of the state of Queensland. This survey, conducted during ideal seasonal conditions for plant collection, has returned several records of rare or threatened taxa, as well as substantial range extensions of other plants. The most significant of these, the third collection of the rare *Glossocardia orthochaeta* (F. Muell.) Veldk., is outlined below.

This taxon was originally described as *Glossogyne orthochaeta*, from a single specimen (Mueller 1891). Veldkamp (1992) recently transferred the 3 Australian *Glossogyne* species in Australia to the genus *Glossocardia* Cass. A full description of *G. orthochaeta* is given by Veldkamp (1992).

Glossocardia orthochaeta is a striking plant with showy flower heads, the largest (c. 50 mm diameter) within the genus *Glossocardia* in Australia. Even when infertile, it is a distinctive large perennial plant to 80 cm tall (Fig. 1). It can be distinguished from all other Queensland *Glossocardia* by its size, numerous imbricate, non-basal cauline leaves, and presence of reflexed and transversely folded involucral bracts (Veldkamp 1992).

The only prior Queensland Herbarium (BRI) collection of *Glossocardia orthochaeta* is that of C.H. Gittins (collection no. 528), in 1962 from the Stannary Hills. The other collection of this taxon is held at the Royal Botanic Gardens and National Herbarium (MEL), recorded as "Near the South Coen River, 1891, Stephen Johnson s.n." As noted by Veldkamp (1992), no details of habitat have previously been recorded. Indeed, it is nearly forty years since this species was last observed, a criterion that would suggest extinction for some other taxa, eg. fauna.

The Stannary Hills are known as an area of high local floristic endemism, and have undergone much botanical collection in the last 20 years. Several skilled botanists, from BRI and elsewhere, have extensively collected in this area where *G. orthochaeta* has been recorded previously. In addition, the earliest collection from the South Coen River remains the only record within the Cape York Peninsula area, despite extensive collection across this region some 100 years later by Neldner and Clarkson (In prep.). *Glossocardia orthochaeta* is a conspicuous plant in the field (Veldkamp 1992; pers. obs.), and is unlikely to have been missed. These observations suggest that the species is highly localised, or is restricted to microhabitats not frequented by plant collectors.

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Austrobaileya 6 (2): 341–343 (2002)

Specimen details

Queensland. North Kennedy District: Kallanda Station, about 50 km W/SW of Ingham, N. Queensland. 18°, 50'S 145° 50'E, April 2001 *Pollock 1083 & Turpin* (BRI).

Habit: An erect forb to 0.5 m tall with dark green sub-fleshy leaves, and large bright yellow flowers (Fig 1). Rare at this locality, only c. six plants observed, with only one individual flowering.

Habitat: Steep rocky granite gorge with boulder stacks and open areas of granite pavement. Soils are granitic lithosols. Growing on the edge of very tall open woodland of *Araucaria cunninghamii* with mid-dense shrub layer of *Labichea nitida* and *Acacia leptostachya*. A thin grassy ground layer of *Digitaria* sp. and *Eriachne pallescens* is present.

Distribution: This record is a significant range extension, some 220 km from the previous record of Gittins, making it the most southerly known. The range of this species covers some 700 km in total (Map 1).

Status: This species is currently recorded as "Rare" in the 2000 schedule of the Nature Conservation Act (1992). However, it is the author's opinion that the conservation status of this taxon needs to be reappraised. With no recent collections other than described above and no known populations conserved, it seems that a conservation coding of Vulnerable (VU) is appropriate, as category D of the IUCN Red list (Anonymous 2001) is fulfilled (population characterised by an acute restriction in area of occupancy (< 100km^2) and found in less than 5 locations).

This species is likely to be found on granite rock pavements in partially shaded areas close to minor creeks, perhaps on the ecotone between dry vine or shrub thickets and open grassy woodlands. Gorge lands or deep valleys with moist influence may also be suitable. Further searches in suitable areas within its current known range are needed in order to determine the full extent of the population in this area.

Acknowledgements

Many thanks to the owners of Kallanda Station, for allowing access to their property. Thanks also to Ailsa Holland for assistance in the initial identification of this species, and for comments on drafts of this paper. Donovan Sharpe provided the specimen photograph. Rosemary Niehus kindly helped to produce the map.

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Map 1. Distribution of *G. orthochaeta* in north-east Queensland



Fig 1. *Glossocardia orthochaeta* F. Muell (Veldkamp). *A.B. Pollock 1083 and G. Turpin*, Kallanda Station, North Kennedy Pastoral District (BRI). (Approx. half natural size).

Austrobaileya 6 (2): 345 (2002)

Note

Two new combinations in *Corymbia* K.D.Hill & L.A.S.Johnson (Myrtaceae)

The genus *Corymbia* was described by Hill & Johnson (1995). While the circumscription and rank of *Corymbia* are the subject of continuing debate among Australian botanists, it has, for the present, been accepted by all major Australian herbaria as portrayed by its authors.

This being the case, new combinations are required to more accurately describe two taxa from north Queensland.

Corymbia serendipita (Brooker & Kleinig) A.R.Bean, **comb. nov.**

Eucalyptus serendipita Brooker & Kleinig, *Field Guide to Eucalypts Vol.* 3, p. 371 (1994). **Type**: Queensland. [Cook District:] hills between Robertson and Gilbert Rivers, SW of Forsyth, 6 November 1992, *M.I.H. Brooker* 11380 & *D.A. Kleinig* (holo: CANB; iso: BRI, MEL, NSW).

Corymbia arnhemensis subsp. *monticola* K.D.Hill & L.A.S.Johnson, *Telopea* 6: 273 (1995). **Type**: Queensland. [Cook District:] Chudleigh Park station, southern Gregory Range, on track to upper Stawell River, 29 July 1990, *K. Hill* 3733 & *L. Stanberg* (holo: NSW; iso: BRI, CANB).

C. serendipita differs significantly from *C. arnhemensis sens. str.* by its cuneate juvenile leaves (*vs.* sagittate), its adult leaves with numerous island oil glands (*vs.* glandless), and its bark which abruptly changes from rough to smooth.

Corymbia stockeri subsp. **peninsularis** (K.D.Hill & L.A.S.Johnson) A.R.Bean, **comb. nov.**

Corymbia hylandii subsp. *peninsularis* K.D.Hill & L.A.S.Johnson, *Telopea* 6: 284 (1995). **Type**: Queensland. Cook District: levee on N side of Archer River, Peninsula Development Road, *K. Hill* 1769, *P. Hind & D. Healey*, 22 July 1986 (holo: NSW; iso: BRI, CANB, PERTH).

C. stockeri subsp. *peninsularis* is clearly allied to *C. stockeri* subsp. *stockeri*, and differs from it mainly by the lesser amount of rough bark and the lack of "speckles" on the fruit. The two taxa appear to intergrade north of Laura.

Brooker & Kleinig (1994: 71) treated *C. stockeri* in the broad sense, extending from Cape York to Irvinebank, but I feel that a distinction at subspecies level is warranted.

C. hylandii differs from *C. stockeri* by its smaller stature, the non-scurfy buds, shorter fruits, grey-brown bark persistent to smaller branches, and the rather dull adult leaves. It grows on metamorphic substrates in the Laura-Mt Carbine-Dimbulah areas.

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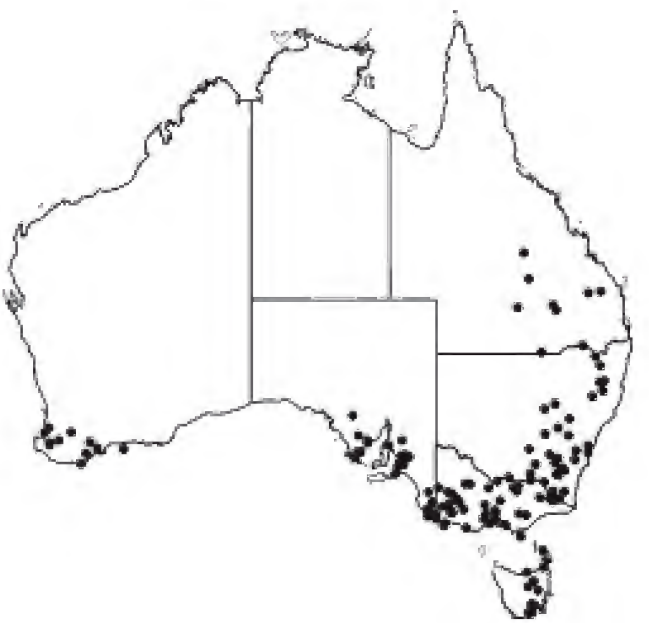
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Addition

Austrobaileya 6 (1): 2001

The map (Map 6.) referred to on p. 26 line 52 column 2 was omitted from the article. A copy of the map is shown below.



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